

MUSIC, MIND AND MENTAL ILLNESS

A study of expression in and emotional experience
of music in normal subjects and in patients
within different diagnostic groups

Sören Nielzén



Department of Psychiatry
University Hospital
Lund Sweden

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Akademisk avhandling

som med vederbörligt tillstånd av Medicinska fakulteten vid
Lunds Universitet för avläggande av medicine doktorsexamen
kommer att offentligen försvaras i Stora föreläsningssalen,
Psykiatriska kliniken, Lasarettet i Lund, torsdagen den 29
april 1982 kl. 9.15.

Organization LUND UNIVERSITY Department of Psychiatry University Hospital Lund, Sweden	Document name DOCTORAL DISSERTATION	
	Date of issue 1982-04-31	
	CODEN: LUMEDW/ (MEPL-1002)/1-29 (1982)	
Author(s) Sören Nielzén	Sponsoring organization The Swedish Medical Research Council Faculty of Medicine, Lund University	
Title and subtitle		
MUSIC, MIND AND MENTAL ILLNESS. A study of expression in and emotional experience of music in normal subjects and in patients within different diagnostic groups		
Abstract The present thesis concerns the perception of emotional meaning in music in normal subjects and in patients with various states of mental disorder. Pieces of music were composed for a small symphony orchestra, recorded on tape and used as stimuli. Their expressive structure was defined by factor analyzing the ratings of technical elements of the music made by musically educated individuals. Three structural factors emerged: SIMPLE-SOPHISTICATED, VIVID-PLACID and DARK-LIGHT. Perception of emotional meaning was measured by ratings on semantic differential which in a factor analysis was shown to describe mainly three experiential factors: TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION. In normal subjects "sophistication" in the music was closely correlated with experience of "tension" while "vividness" correlated with "gaiety". Once reproducibility, validity and reliability of the method had been assessed, studies of the influence of background factors such as personality, age, sex and drugs were undertaken. Similarly, the effect of mental disorders on the experience of music was studied. Psychopathological factors were found to exceed other factors in importance. Among psychotic patients schizophrenics considered the music distinctly "attractive", while manics and depressives rated it as decidedly "gloomy". In the neurotic patients, depressives experienced the music as "gloomy" and "repulsive", while obsessives exaggerated "tension". Hysterical neurotics varied in their experience of "tension" but found all the music "gay" and "attractive". Anxiety was associated with neutral ratings of "tension" and "gaiety" and high ratings of "repulsion". A special study revealed that tempo is crucial for the emotional experience of music in manic patients.		
Key words Expressive structure of music, perception of emotional meaning, psychopathological perception, psychiatric diagnostic groups.		
Classification system and/or index terms (if any)		
Supplementary bibliographical information		Language English
ISSN and key title		ISBN
Recipient's notes	Number of pages 157	Price
	Security classification	

Distribution by (name and address)

Sören Nielzén, M.D., Department of Psychiatry, University Hospital,
 S-221 85 LUND, Sweden

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Dedicated to Kerstin

The thesis is based on the following five papers
by Sören Nielzén and Zvonimir Cesarec.

- I On the Perception of Emotional Meaning in Music.
 Psychology of Music, 9, no. 2, 1981. In press.
- II Emotional Experience of Music as a Function of
 Musical Structure. Psychology of Music, 10,
 no. 2, 1982. In press.
- III Aspects of Tempo and Perception of Music in
 Mania. Acta Psychiatrica Scandinavica, 1982.
 In press.
- IV Emotional Experience of Music by Psychiatric
 Patients Compared with Normal Subjects. Acta
 Psychiatrica Scandinavica, 1982. In press.
- V The Effect of Mental Illness on the Emotional
 Experience of Music. Archiv für Psychiatrie
 und Nervenkrankheiten, 1982. Accepted for
 publication.

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ACKNOWLEDGEMENTS

My thanks are due to the patients and the volunteers, who kindly took part in the experiments as subjects. I am most indebted to my co-author Zvonimir Cesarec, who has been my scientific tutor for almost ten years, during which time he has shown never-failing patience.

Thanks are also due to Leif Robertsson for advice and statistical processing, to Robert Dewsnap for his scrupulous work on this English text, to Thomas Nicklasson for recording the music and to Rolf Holm at CIBA/GEIGY läkemedel, Västra Frölunda, for giving advice and preparing the pharmacological study.

I want to express my gratitude especially to professor Rolf Öhman who, as the supervisor of the thesis, has in every possible way facilitated and encouraged the completion of my work. His positive criticism and practical advice have been invaluable.

My thanks are also due to the late professor Lennart Nilsson and to professor Eberhard Nyman who kindly placed the facilities of their institutions at my disposal.

Professor David H. Ingvar and professor Gudmund Smith deserve thanks for reading and commenting on the papers and for stimulating and supporting discussions. Eva Skagert, who typed and retyped the manuscripts, is thanked for her loyal and competent co-operation. I am also grateful for the secretarial assistance given by Hanna Britt Franzén, Maria Regnér and Bengt Åseby.

The study was supported by grants from Nerander's Foundation, Henrik Sjöbring's Foundation, the Faculty of Medicine, Lund and the Swedish Medical Research Council, project No. B82-21X-4803-78.



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INTRODUCTION

The present thesis concerns the study of specific aspects of music, the emotional experience of music in normal subjects and the influence of mental illness on the experience of music which is often taken to represent a mainly emotional stimulus. The thesis is based on five studies that will be referred to by their Roman numbers later on, and the titles are as follows:

- I On the perception of emotional meaning in music.
- II Emotional experience of music as a function of musical structure.
- III Aspects of tempo and perception of music in mania.
- IV Emotional experience of music by psychiatric patients compared with normal subjects.
- V The effect of mental illness on the emotional experience of music.

Relevant literature of the research area has been compiled and reviewed in the five separate studies. Thus Study I reviews work where multifactorial statistics has been applied to the perception of music (1,2). Studies concerning the influence of various background factors (education, age, sex, situational conditions etc.) and the importance of personality are included as well. Study II summarizes various efforts to find scientifically satisfying descriptions of musical structure and studies dealing with relations between structure (style) and experience (3,4). The object of interest of Studies III and IV is the relationship between normal and pathological experience; here, studies dealing with both normal subjects and subjects with psychopathological symptoms are brought together (5,6). Similarly papers containing only psychopathological groups are collected in the last paper, Study V (7,8).

The present studies were conceptualized in a positivistic frame of reference. Placed in an experimental setting, the subjects were presented with a musical stimulus from a tape recorder through earphones and were asked to respond using a semantic differential. Thus, the design was a stimulus-response situation applied to various groups of subjects in a standardized way. By taking into account such factors as sex, age and personality, on the one hand, and musical structure, on the other, it was possible in studies I and II to verify that music constitutes a relatively efficient channel in inter-individual communication. Structures that are commonly used by composers in Western music to express emotional qualities are understood by musically uneducated listeners in comparable terms of semantic ratings. It would have been possible, of course, to treat the rating data with respect to many other influences, such as stated mood or degree of musical education. The main aim was to concentrate upon differences between normal subjects and psychiatric patients and therefore no further studies on the influence of the various background factors were planned. As psychiatric patients often receive drugs, a project was undertaken to study the effect of such drugs on the perception of music. Computations of reliability were also performed (cf. METHODS below).

A model of communication was used for interpretative purposes in Studies I and II. In relation to illness and its influence on the perception of music, terms such as "emotional expression" and "emotional experience" may seem obscure. However, certain disorders affecting our emotional life occur within psychiatry (9,10). Such cases were included in Studies IV and V. However, due to the methods used it is not the emotions evoked in the patients that are studied, but the patients' capacity to recognize the intended emotional meaning in the music. It was assumed that

this capacity might be affected by the pathological condition; this hypothesis was verified. The results reflect a real change in the process of communication related to the illness in question.

The change in ratings in the diagnostic groups may be considered as a result not only of a specific "emotional" process. It may also reflect more purely cognitive and perceptual processes. In the discussions in Studies IV and V, reference has been made to circumscribed disorders demonstrating disturbances of perception. The present study of auditory perceptual changes may therefore provide a basis for further exploration of relations between perceptual disturbances in mental illness and physiological, anatomical, biochemical and other factors of importance for the psychopathology in these diagnostic groups.

AIMS OF THE STUDIES

Patients with major psychoses experience their physical surrounding in a distorted way. Therefore when initiating the present studies the general aim was similarly to find evidence of distortions in the perception of auditory stimuli in certain conditions of mental illnesses (11,12). Patients showing symptoms of emotional disorder were chosen as objects for the study of the psychopathological aspects. Varying expressive patterns of music were chosen as stimuli carrying emotional messages evoking reproducible responses in normal subjects (13,14).

S T U D Y I

To find a method to measure emotional experience of music (for future application of the method it was also necessary to assess its reliability and to study the effect of drugs on the experience of

music) and to analyze the influence of background factors such as sex, personality and age.

S T U D Y I I

To define complexes of structural elements that may constitute expressive style and to relate such styles to the emotional experience thereof.

S T U D I E S I I I and I V

To search for evidence of differences in the emotional experience of music between normal subjects and patients with mental disorders producing emotional symptoms.

S T U D Y V

To assess the quality of emotional experience in psychopathological groups by means of intergroup comparisons.

Clinical subjects

The clinical subjects included in the present studies were all observed as in-patients at the psychiatric ward of the University Hospital. The diagnostic criteria for inclusion of patients in the studies were those compiled in the DSM-III diagnostic manual. This manual is based upon a multi-dimensional way of approaching the diagnostic process. The edition of 1978 contains 5 axes each of them confined to one of the following concepts in this order: clinical symptoms, personality disorders, physical disorders and conditions, severity of psychosocial stressors and highest level of adaptive functioning during the past year. It is based upon current clinical experience of Western culture and it "ensures that attention is given to certain types of disorders, aspects of environment

and areas of functioning that might be overlooked if the focus was on assessing a single presenting problem" as it is put in the manual.

The diagnoses were independently made by the medical staff responsible for the patients' care. These decisions have been reviewed in relation to the DSM-III system.

The study excluded patients demonstrating signs and symptoms of drug abuse. It also excluded patients with concurrent somatic disorder, or lesions of the central nervous system as documented by neurological examination and, where indicated, by psychometric tests, EEG and studies of cerebral blood flow.

All patients had a duration of their clinical syndrome of more than one month before admission to the study. Even within this diagnostic frame of reference some overlapping between the clinical diagnostic groups may actually exist since the mode of classification is basically of a phenomenological rather than an etiological type.

The reference group comprised selected individuals in full employment found apparently healthy during a clinical interview and denying problems of mental health. They all reported that they possessed normal hearing. They were not selected by specific abilities or interest in music and they were of medical students, medical staff and other adult individuals who volunteered when confronted with the project.

For the structural analysis of the pieces of music used in the study, 8 individuals were engaged who were educated at a music student level and who were currently performing music.

METHODS

Pieces of music were composed to be used as stimuli and they became defined by their varying content of expressive elements such as diminuendo-crescendo, staccato-legato, rising complexity of harmony, consonant and dissonant melody etc. (15). Orchestration was performed for a small symphonic orchestra in such a way that combinations of instruments covered each other so that no single instrument dominated to cause exaggerated ratings due to individual preference or disapproval of certain timbres (appendix - phonographic record).

The reference music composed for this study according to norms within the classical style of music appeared to be comparable to the sample of classical music for symphony orchestra used in Study II. Ratings of structural content were factor analyzed and two common delineated structural factors were extracted: SIMPLE-SOPHISTICATED and VIVID-PLACID. A third structural factor was extracted from the reference compositions labelled DARK-LIGHT. Behind the use of short sequences of orchestral music lay the assumption that simple sounds, chords, tones, signals and so on were too poor in structure to induce an emotional experience. Such stimuli may be used to test neurological or specific cognitive audiological functions, but the simultaneous action of many simple structural elements may make the receiver experience the stimulus at a more integrated level that we may call emotional. Among other conditions, homogeneity of a stimulus and a well-adjusted length of the piece of music were obviously crucial for inducing reproducible emotional responses. Any allusion in the music to a well-known theme or style was avoided in order not to evoke feelings of personal experience.

Personality traits were assessed by means of CMPS (Cesarec-Marke Personality Inventory) (16). This schedule contains 165 specific questions and describes 11 items of social needs and 5 personality factors according to the theory of personality presented by Murray (17). It has been widely used in medical research in the countries of Northern Europe and has proven to yield valid and reliable information (Study I).

The assessment of emotional experience by means of ratings on a semantic differential was used as the dependent variable throughout the studies. The semantic differential consisted of 12 scales, 4 of which represented each of 3 experiential factors: TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION. These factors resulted from a preliminary analysis (Study I).

The construction of the final form of the semantic differential was based on this factor analysis of 20 original scales. The 3 factors were extracted by means of varimax rotation, which is a method that fits the correlation matrices to the best solution of orthogonality (18). The 3 factors explained 57 % of the total variance, which is a high percentage in comparison with many similar studies in this field. The 3 factors had eigenvalues higher than 1.0 and the subsequent factors showed a sudden decrease to negligible values about ten times lower. In order to be able to estimate the test-retest reliability, correlations of ratings on two occasions by 45 normal subjects were computed. They rated the 7 pieces of music (Study I) twice, at an interval of 10 days.

To obtain a measure of internal consistency split-half correlations were computed for each of the experiential factors: the single scales in each factor were rank ordered from 1 to 4, according to the magnitude of the factor loadings in the rotated

matrix. Scales nos. 1 and 3 were then correlated with scales nos. 2 and 4 (19).

The influence of psychotropic drugs on the experience of music required specially close attention since many of the patients in Studies IV and V were receiving such drugs. Therefore, these patients within the schizophrenic and neurotic depressive groups were compared with those in the same groups not receiving drugs. A special investigation with 12 healthy volunteers, 6 men and 6 women from 19 to 40 years of age (mean age 27.9, SD 6.45) was undertaken as well. The experiment continued for 2 weeks, during which the subjects were given 25 mg thymoleptic drugs (Anafranil ®, Ciba-Geigy) twice or two placebo daily in a double-blind, cross-over, double-dummy design. They listened to the seven (Study I) pieces of music and completed the semantic differential at the start of the experiment, after the first week and finally after the second week.

Statistical methods used in Studies III, IV and V in comparing various groups with each other were analysis of variance and t-tests (19,20).

GENERAL RESULTS

The ratings in the three experiential factors (Study I) were found to differentiate the compositions from each other at highly significant levels. (Factor I: TENSION-RELAXATION, $F = 27.84$, $p < .001$, Factor II: GAIETY-GLOOM, $F = 53.08$, $p < .001$ and Factor III: ATTRACTION-REPULSION, $F = 8.21$, $p < .001$, $N = 50$, analysis of variance of factor scores, unweighted means solution.) The pieces of music thus evoked emotional experiences with great differentiation (cf. APPENDIX: Figures).

Correlations of the factor scores in the test-retest experiment are presented below (Table I).

Table I.

	Factor I	Factor II	Factor III
	TENSION	GAITY	ATTRACTION
	-	-	-
	RELAXATION	GLOOM	REPULSION
Correlation coefficient (N = 45)	.57	.77	.67

The computation of the measure of internal consistency resulted in the following figures of split-half correlations (Table II):

Table II.

	Factor I	Factor II	Factor III
	TENSION	GAITY	ATTRACTION
	-	-	-
	RELAXATION	GLOOM	REPULSION
Correlation coefficient (N = 45)	.70	.77	.67

The double-blind study of effects of the thymoleptic drug resulted in no significant differences between no drug versus drug (Anafranil®) scores, no drug versus placebo scores or drug (Anafranil®) versus placebo scores (Table III).

Similarly comparisons between patients within the neurotic-depressive and schizophrenic psychotic diagnostic groups receiving thymoleptics and neuroleptics respectively and those who were on a drug free regimen did not indicate any significant differences (Table IV).

Table III. T-values in comparisons between those who received placebo (P), thymoleptic drug (T) and no drugs (N).

	<u>N/T</u>	<u>N/P</u>	<u>T/P</u>
<u>Factor I</u>			
TENSION-RELAXATION	.05	1.16	1.37
<u>Factor II</u>			
GAITY-GLOOM	-.06	1.60	1.39
<u>Factor III</u>			
ATTRACTION-REPULSION	1.68	.17	-1.16

Table IV. T-values of comparisons between schizophrenic patients receiving neuroleptic drugs (M) and drug-free schizophrenic patients (N) and depressive patients receiving thymoleptics (M) or free of drugs (N).

	Factor I	Factor II	Factor III
	TENSION	GAITY	ATTRACTION
	-	-	-
	RELAXATION	GLOOM	REPULSION
Schizophrenic patients M(n=12)/N(n=9)	1.41	.03	.23
Depressive patients M(n=9)/N(n=16)	-.10	-.70	-1.16

In Study I few differences in emotional experience of music due to the influence of background factors such as sex, personality and age were obtained. The music was experienced as more attractive with increasing age, and women rated "tense" music as more tense than did men. Individuals with demonstrated need affiliation were at a nearly significant level ($p < .07$) rating the music as less tense, dominating persons and those with low need defence of status rated the music as more gay ($p < .05$, $p < .02$) and patients with a neurotic self assertion rated the music as less attractive. In Studies III, IV and V concerning pathological states significant differences are more prevalent. While in Study I 17/120 comparisons were

significant below the .05 level, there were 47/168 significant differences in the later studies.

In Study II a high correlation was demonstrated between some structural factors of music and experiential factors. Thus vividness in the music was closely correlated with the experience of gaiety; and sophistication in the music made the subjects experience it as more tense.

In Studies III, IV and V it was concluded that the experience of music is significantly influenced in several ways in different psychopathological states.

Manic psychotics (Study III) were found to be sensitive to the tempo of music. They rated a slow piece of music as more tense and less gay than normal subjects did. The listening to a fast piece of music on the other hand led to a greater change towards experiences of gaiety and attraction than in reference individuals. The ratings by manic patients became more similar to the ratings by the reference individuals as an effect of the increase in tempo in music.

A major result in Study IV was the finding that ratings of tension showed a central tendency in all diagnostic groups except those consisting of obsessive and hysterical neurotics. Patients in these groups experienced all degrees of tension. They also experienced significantly more tension than normal subjects in the most "tense" piece of music. In factor II (GAIETY-GLOOM) depressive patients and manic psychotics concordantly rated the "gay" music as less gay. In Factor III (ATTRACTION-REPULSION) schizophrenic psychotics rated the music as more attractive, while depressive and anxiety neurotics experienced the music as more repulsive than did normal subjects.

Fig. 1a.

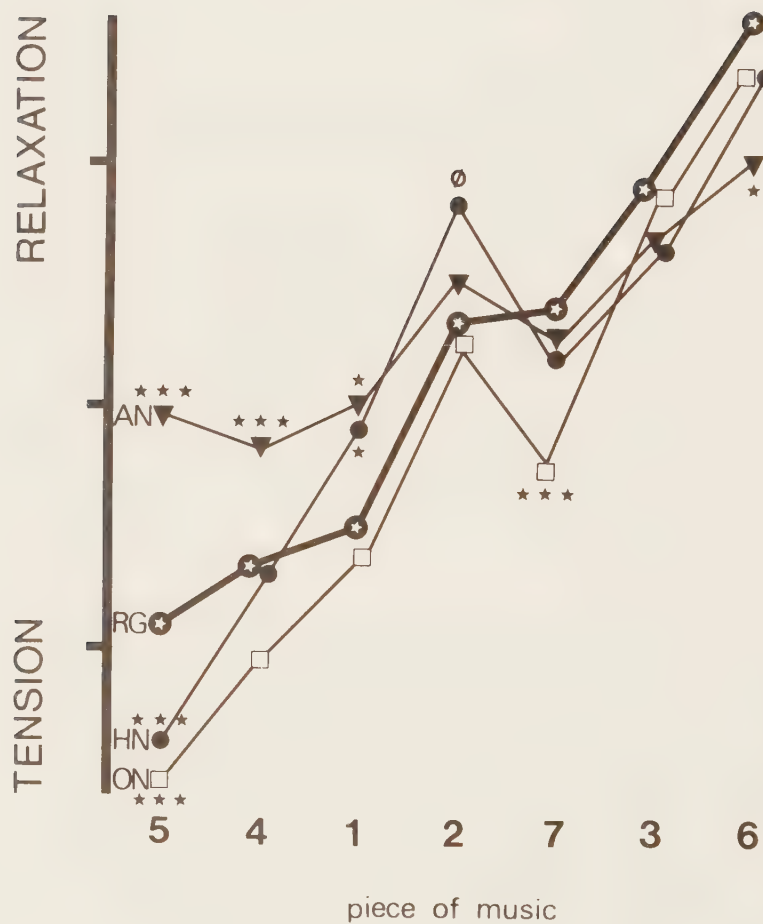


Fig. 1b.

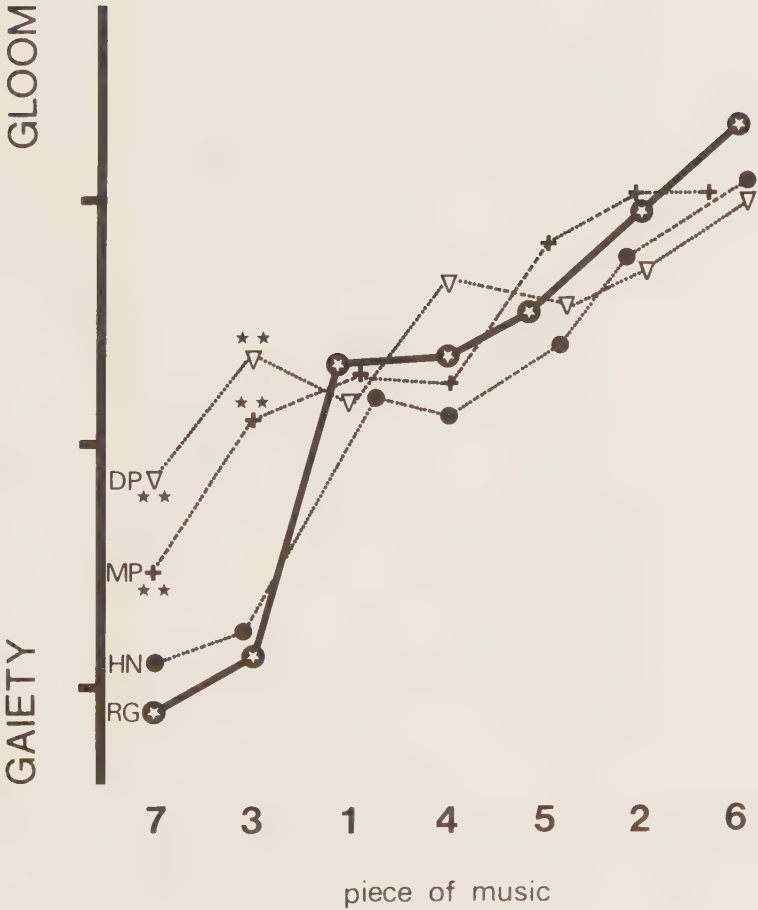
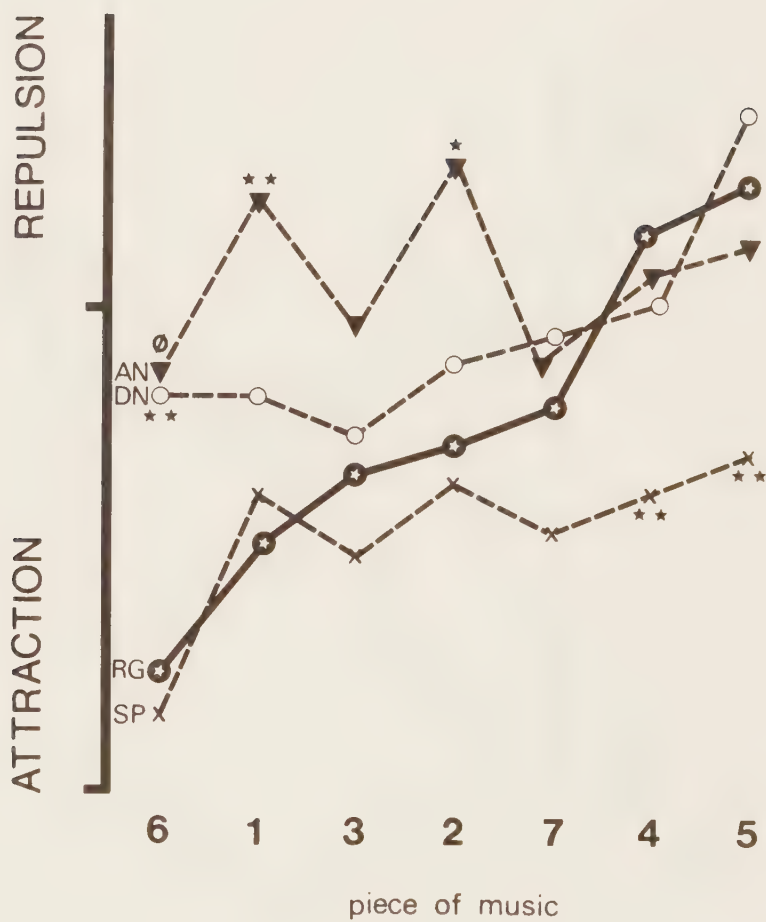


Fig. 1c.



●* RG = Reference Group (n=100)
 ▼ AN = Anxiety Neurosis (n=12)
 ● HN = Hysterical Neurosis (n=19)
 □ ON = Obsessive Neurosis (n=12)
 ○ DN = Depressive Neurosis (n=20)
 + MP = Manic Psychosis (n=10)
 X SP = Schizophrenic Psychosis (n=22)
 ▽ DP = Depressive Psychosis (n=12)

Ø = $p < .1$
 ★ = $p < .05$
 ★ ★ = $p < .01$
 ★ ★ ★ = $p < .001$

Fig. 1. Representation of main patterns of ratings by normal subjects and patients in different diagnostic groups of TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION (mean factor score for each group and piece of music).

In Study V further polarisation of results was obtained. The group of anxiety neurotics was found to be the most affected one, showing central tendency in both Factors I and II. These patients experienced the music as more repulsive than other groups. Obsessive neurotics experienced more tension in all pieces of music than most of the other diagnostic groups. Hysterical neurotics rated all music as more gay than others and schizophrenic psychotics were the most prominent group as regards high ratings of attraction in music (Fig. 1).

Significant additional and intriguing results of the present studies deserve further attention. It was found (Study IV; appendix; Table of t-values in comparisons between ratings by normal subjects and patients) that manic psychotic and depressive neurotic patients rated varying levels of tension in the two most "tense" pieces of music while the reference group rated the level of tension as about equal in them (Fig. 2, Study IV). Furthermore, a sophisticated, placid and dark piece of music (Studies II and IV) was by hysterical and obsessive neurotics rated as less tense than a simple vivid and light one. (Pieces nos. 2 and 7: appendix; Table of t-values in comparisons between ratings by normal subjects and patients.) The depressive neurotics rated less gloom in 3 "gloomy" pieces of music than normal subjects.

GENERAL DISCUSSION

Distorted perception of the environment and inadequate interpretation and expression of emotional stimuli are well-known features of many psychopathological states (21). This applies both to conditions of actual psychiatric disorders and to those secondary to environmental influence such as intoxication and brain lesions. Such disturbance may be due to changes at a sensory level or at a level of interpretation

and response to stimulus. So far it has not been possible to conclusively demonstrate that the disturbances just mentioned apply to the primary receptor level (22).

Therefore, previous attempts to evaluate perceptual disturbance in mental disorder may have been too limited in their use of auditive, visual, tactile or other defined stimuli to engage the process of interpretation and expression in emotional qualities (22). The object of the present study was to explore the possibility of employing a complex but defined musical stimulus and to study the emotional interpretation in certain types of mental disorder.

Expressive features of composition are varied and potentially inexhaustible. Therefore, meaningful interpretation is only possible when the stimuli used - as in the present case - are comparable. When specific means such as transient processes (e. g. crescendo, diminuendo, accelerando, ritardando) spectacular effects (odd instruments), ostinati or resting tones or ethnically determined specific expressions are used, one has to reevaluate the ways of obtaining an efficient scientific description of the structure of music. Without doubt, semantic differential has shown its capacity both as an aid in evaluating the structural content of music and for the study of response to music (Studies I and II).

The capacity of the selected compositions to evoke a reproducible interpretation (expressed by factor scores) by healthy individuals was a prerequisite for the project. The significance of discrimination was shown to be reassuring (cf. GENERAL RESULTS). The high values of the split-half correlations show that the scales that originally were highly loaded in the factor analysis have shown an inner consistency

also when applied to other groups of subjects. Similarly the test-retest correlation was high. The method employed was therefore suitable for group comparison. It should, however, be stated at this point that the technique in its present form is not a diagnostic tool.

The results of the investigation on the influence of thymoleptic drugs showed no evidence that these cause a major change of perception of emotional meaning of the musical stimulus. The subjects, clearly affected by side-effects of the drugs such as sweating, dullness, dizziness etc. were not affected in their ratings. Neither did neuroleptic drugs measurably influence the ratings in the schizophrenic group. Similarly it has been observed throughout the studies that background factors such as age, sex and personality seem to exert only a minor influence on the communication of music in the experimental setting. Music was therefore characterized as an "efficient channel of communication" (Study II). In summary, such background factors, and specifically psychiatric drugs, thus seem to be of negligible importance in comparison with the effects of psychopathological states.

All of the psychopathological groups chosen for the studies have shown general and/or specific characteristics in their perceptual distortion of the intended emotional meaning of the music. The most apparent findings were the following: schizophrenic psychotics rated the music as more attractive than others, while depressive psychotics exaggerated the gloom in the music as did manic psychotics. The latter group was in addition found to be dependent on tempo in a specific way. The manic psychotics also rated the music as more attractive than all other patients except schizophrenic psychotics. Obsessive neurotics recognized tension in music in a significant way while

the hysterical neurotics rated the music as more gay. This last group also showed a great variation in the ratings of tension in music. Interestingly, the anxiety neurotics were characterized by an inability to get involved in or recognize the adequate level of tension and gaiety in the music and rather judged the music to be more repulsive. Depressive neurotics disliked the music and rated it as more gloomy.

The findings concerning the schizophrenic group do not in any specific way contribute to the interpretation of this intriguing disorder. However, it should be noted that the high ratings of attraction which were outstanding in comparison with those seen in other groups may have relevance in conjunction with current theories regarding hyperattentional states in this disorder. The nature of the autistic trait, central to the schizophrenic symptomatology, may therefore not be simply referred to as a withdrawal phenomenon. The present results support a view that the schizophrenic patient experiences an intense, unfading and detailed perception of stimuli. Increasing complexity of the stimulus does not prevent the communication. However, from a point of view of an outside clinical observer the responses of the schizophrenic patient are disintegrated, inadequate or withheld (23,24).

As might have been expected, patients with psychotic and neurotic disorders with depressive symptomatology did not realize gaiety in music or, if they did, they suppressed their experience of it. These findings are in accordance with the well-known inability of the depressive patient to experience any environmental stimulation as gay. The results of the ratings by patients with manic psychoses demonstrated a pattern that in most respects resembled that of depressive psychoses. These conditions reflect in many patients the extremes of a clinical syndrome supposedly

having an etiology determined by common factors. The disturbance of perception noted in this study may therefore be understood as a reflection of a common psychopathological factor. In clinical reality we also have to recognize a borderland between manic and depressive psychosis, where we may in fact meet with diagnostic difficulties concerning agitated depressive psychoses and patients with manic psychoses showing aggressiveness and mood swings.

As discussed above, the delineations of obsessive, anxiety and hysterical neurotic groups may not be as clearcut as those of psychotic states (25). Still, these neurotic groups demonstrate significantly different patterns of musical perception. The anxiety neurotics may be the most interesting group in this respect. As seen in the data presented in this study (Study IV) they have a consistent central tendency i. e. they experience less of the variation or amplitude of the musical message. Possibly the work-load of controlling inner tension and vegetative sensations precludes any detailed perception of the musical stimuli.

The hysterical and obsessive neurotics perceive the music in a way that is more similar to the reference group. One exception may concern the factor TENSION-RELAXATION. Patients with obsessive states experience more tension, while hysterical neurotics irregularly deviate from the pattern of experience rated by normal individuals. The deviations from the normal pattern observed, however, are not striking and do not invite further speculation on the presumed differences with regard to defence strategies in these conditions (26).

The present study has included a vast number of comparisons based on analyses of variance. The results

represent observations supported by group-specific common trends in experience of music. Otherwise observed relations may have statistical but not clinical significance. Among the several isolated findings of the present study it still seems appropriate to note the finding that pieces of music, not differentiated by the reference group, in respect to the factor TENSION-RELAXATION were perceived in a significantly different way by both depressive neurotics and manic psychotics. It might therefore be concluded that certain discriminatory functions may be attenuated in certain pathological states in comparison with the healthy individual. In clinical experience this has been observed in organic brain syndromes, where the sensitivity to certain auditive stimuli is raised (27). To our knowledge such a distortion of perception has not been evaluated in the psychopathological states described in this study.

Manic psychotics approach a normal pattern of rating of musical qualities when the tempo becomes fast in the music. This observation has previously been noted by other investigators using tempo tests (28). It is not at this point relevant to expand on this interesting finding. Similarly other significant deviant patterns of perception in various pathological states may require further studies for a meaningful interpretation. It is felt that several structural qualities hidden in the pieces of music used in this study, but so far not systematically investigated, may lead to further findings of significantly deviating patterns of perception. Among these are with certainty timbre and consonance-dissonance (29).

GENERAL CONCLUSIONS

1. A method has been devised to employ reproducible musical stimuli for the study of perceptual qualities.
2. The elements of the stimulus have been reduced to major factors of style by an analytical procedure.
3. The devised procedure of testing has shown validity and reliability.
4. Different pieces of music can be rank ordered by normal subjects concerning separate experiential factors according to factor scores of emotional experience obtained by means of ratings on semantic scales.
5. Ratings of the standardized musical stimulus applied to groups of psychopathological states reveal a great number of deviations from the normal pattern of perception.
6. Patients within 7 diagnostic groups of psychopathological states demonstrate patterns of perception which deviate in a significant way from the reference group.
7. The quality of auditive perceptual distortion may be referred to any level of processing of the sensory input. The involvement of emotional qualities indicates that central processes of integration and interpretation in the nervous system may be measurably affected.

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PAPER I.

ON THE PERCEPTION OF EMOTIONAL MEANING IN MUSIC

Sören Nielzén and Zvonimir Cesarec

Department of Psychiatry, University Hospital and
Department of Psychiatric Research, S:t Lars Hospital,
Lund, Sweden

INTRODUCTION

The perception of emotional meaning in music is one of the final events in a communication process. This consists of the transmitting of messages from a transmitter to a receiver via one or more channels. As regards music, composing and performing are examples of coding and transmitting activity. Vocal or instrumental execution and the playing of recorded music represent various types of channels. Experiencing and decoding the music then concern the receiving of the message. The study of communication processes has to take into account the influence of sources of error at different levels. Weaver (1954) mentions three levels of communication problems: How accurately can the symbols of communication be transmitted? (The technical problem.) How precisely do the transmitted symbols convey the desired meaning? (The semantic problem.) How effectively does the received meaning affect conduct in the desired way? (The effectiveness problem.)

The symbolic presentation, i.e. written music or tonal patterns in a musical performance, stores a complex structure of information and a piece of music then transmits a large quantity of simultaneous messages. The technical problem in composition, orchestration, performing, recording, etc., is quite conspicuous. The semantic problem also arises from the structural complexity of the music.

Both the notation convention and performing traditions may have distorting influences upon the message; the various types of orchestration, interpretation, etc., may add or subtract parts of the information. So may irrelevant impressions from the listening milieu and memories attached to the music. These sources of error are discussed in many experimental

studies (Watson, 1942; Sopchak, 1955; Cantor and Zillman, 1973).

The effectiveness problem cited above concerns the individual who perceives the music. Besides the above-mentioned influences, personality traits and physical or mental illness can interfere with the effect of a musical message (Mitchell and Zanker, 1949; Weidenfeller and Zimny, 1962). Psychoanalytic theory offers one possibility of interpreting how individual characteristics may influence the perception of music (Kohut and Levarie, 1950; Ehrenzweig, 1953; Arieti et al., 1976). This theory describes different levels of mental function related to the development of personality and it also takes into consideration how these levels of functioning may be unbalanced in mental illness. Thus a sort of primitive, dreamlike, a verbal and prelogical kind of cognitive function is called "primary process", while logic and coherent thinking employing verbal symbolisation is designated as the "secondary process". Also the "ego" functioning mainly at the level of "secondary processes", can interfere with the meaning ascribed to musical excerpts due to the action of mechanisms of defence. The manifold possibility of interpreting music due to its vague character makes attributive projection in general relatively common. Projection as a mechanism of defence may sometimes also be used. Isolation of affect and intellectualisation are other mechanisms commonly seen in connection with listening to music. Aspects of expression of affects and its relation to music listening have been studied by, among others, Ridgeway (1972).

In music aesthetics differentiation of various meanings of the messages has been made (Bengtsson, 1972). Meyer (1957), for example, stresses the "designative" contra "embodied" meaning in a musical message. He separates associative, non-musical content from the

meaning created by the structure of music itself. In this case the designative meaning tends to appeal to perception guided by secondary processes, while the embodied meaning may stimulate cognitive functioning at the level of primary processes. In a corresponding way semantic sciences distinguish between "denotative" and "connotative" meaning. Denotative meaning carries information based upon constructive factors of a segment. For example, Gardner et al. (1977) wrote: "The denotation may be carried primarily or even exclusively by the melody alone: "Hail to the chief" denotes the President of the United States to individuals who had never heard that piece's name. At other times the lyrics and the title of a piece prove crucial for an appreciation of its extramusical meaning". Connotation on the other hand refers to the power of music "to convey to listeners in the same culture a certain mood, affect or physiognomic experience". Connotations are very much influenced by the individual frames of reference. The composer often does not intend to transmit a denotative message, the music is then a non-intentional so-called expressive communication. The more "denotative" elements there are in the music, the more the interpretation of it will be guided by conventions, cultural values, education, etc. On the other hand the interpretation of the "connotative" aspects of the communication is guided by individual factors.

As long as we use music in social, therapeutic, political and other circumstances it is an important task to study the processes which influence the perception of music.

S T U D Y I

The purpose was to find dimensions in the emotional experience of music which can be quantified in order to make it possible both to describe how different

pieces of music are experienced and to compare the experience of music of different individuals. Mean ratings of large groups can also serve as a qualitative description of the pieces of music that have been used. Osgood's semantic differential (Osgood et al., 1957; Snider and Osgood, 1969) was considered to be a useful method in this context. In several studies the semantic differential has been applied to describe the emotional meaning of music (Gray and Wheeler, 1967; Nordenstreng, 1969; Wedin, 1969, 1972; Iwata, 1972; Iwashita, 1972; Crozier, 1974) which makes comparison possible. In order to avoid some sources of error, especially to prevent musical associations arising in any special direction of style, 13 pieces of music specially composed by the first author were used. The duration of the compositions varied between 12 and 35 seconds. They also varied with respect to expressive means of composition. Both duple and triple time were used including complex rhythms. The main technique of composition is three-part free counterpoint, except in one piece (XII) which had a four-part harmonisation. Intensity and duration were modified by different dynamics; accents, staccato, legato, etc. In one piece (X) violent changes of intensity, crescendo, decrescendo and accents were the main characteristics.

The instrumentation was not dominated by any characteristic instrument or groups of instruments. The treble part was played by two flutes, four violins and one oboe, the inner part by two clarinets, two French horns and two violas, and the bass part by two cellos, one double bass and one bassoon.

A verbal description of the 13 pieces according to the intentions of the composer was as follows:

1. I. 12 sec. A quiet beginning leads to a climax with a gentle end. The accent is plaintive,

- the harmony more harsh than gentle. Moderately brisk.
2. II. 18 sec. Hesitant beginning. Tragic feeling. The end hesitant and disharmonious.
 III. 11 sec. Lively expression. Ambiguous mood with humorous rhythm and great intervals while harmony is sad.
 3. IV. 10 sec. Rather lively. Indifferent mood with lightening and relieving harmony at the end. Rhythm is confident and stable.
 V. 12 sec. Lively and vigorous rhythm. Frightening harmony and a desperate or tragic mood.
 4. VI. 12 sec. Calm, expansive, secure rhythm. Large and surprising intervals appear. Facetious or slightly frightening with respect to the variability in character.
 VII. 15 sec. Fresh, brisk expression. Minor modality in the harmonies.
 VIII. 15 sec. Calm, simple, natural phrases and decisive end. Mostly light character, but some sad mood in the middle of the piece.
 5. IX. 11 sec. Intense, violent, aggressive style. Serious in character, not joyous, Brisk, decisive rhythm without hesitation or changes of tempo.
 X. 35 sec. Horrifying, ghostly with sudden changes. Strong tensions are built up and are succeeded by diffuse, uncertain parts. Rough harmonies, many unexpected pauses and indecisive rhythms.
 6. XI. 21 sec. Calm, peaceful, intended not to evoke anything that could be associated with tension or agitation. Consonant harmonies.
 XII. 16 sec. Quiet, tranquil rhythm. Slight tension in structure, which is dissolved in a harmonious last chord.
 7. XIII. 8 sec. Same as 3 IV but performed at a slightly faster tempo and in a somewhat more

decisive manner. The piece expresses will-power and strength.

In order to get a description of the music in a more objective way the 13 compositions were rated by eight musically educated persons on a scale with five categories for the following musico-technical aspects:

A - Harmony (dissonant-consonant), B - Modality (major-minor), C - Melody (melodious-amelodious), D - Intensity (pp-ff), E - Pitch (bass-treble), F - Rhythm (marked-vague), G - Rhythmic articulation (sophisticated-unsophisticated), H - Continuity (staccato-legato) and I - Tempo (fast-slow).

SUBJECTS

Fifty persons with normal hearing acuity and without special interest in music, 28 women and 22 men, were used as subjects. The age range was from 20 to 30 years. None of the subjects had a history of or showed signs of psychic insufficiency at the time of testing.

METHODS

Twenty semantic scales defined by pairs of adjectives were constructed as rating scales with seven categories. The scales and their relative order are shown in Table II. The music was played from a tape recorder and was listened to through earphones.

The instruction was that the listener should in his ratings describe the emotional experience evoked by the music. The subject was exposed to one piece of music at a time and rated it immediately after each presentation. The mean time for the rating of all 13 pieces of music was about 40 minutes.

RESULTS

Correlations between rating scales were computed and the matrix was factor analyzed according to the principal factor method (program BMP 03M). Three factors showed greater Eigenvalues than 1.0 and were rotated in accordance with the Varimax method. The rotated factor matrix is shown in Table I.

Table I. Rotated factor matrix for the 20 semantic scales.

		<u>Factor I</u>	<u>Factor II</u>	<u>Factor III</u>
1. Active	- Passive	.28	.65	.19
2. Pleasant	- Unpleasant	-.65	.25	.45
3. Rousing	- Calm	.67	.29	-.22
4. Happy	- Sad	-.20	.81	.08
5. Sweet	- Bitter	-.58	.36	.18
6. Poor	- Rich	.17	-.20	-.63
7. Clear	- Diffuse	-.28	.14	.50
8. Beautiful	- Disgusting	-.58	.19	.57
9. Threatening	- Enticing	.72	-.32	-.20
10. Soft	- Hard	-.82	.06	.23
11. Profound	- Superficial	-.06	-.31	.56
12. Violent	- Peaceful	.84	.16	-.12
13. Tense	- Relaxed	.84	.04	-.21
14. Derisive	- Ingratiating	.59	-.07	-.11
15. Dry	- Sentimental	.54	.14	-.31
16. Amusing	- Boring	-.27	.59	.41
17. Boastful	- Humble	.46	.41	.03
18. Audacious	- Careful	.60	.44	.21
19. Serious	- Humorous	.19	-.78	.18
20. Impulsive	- Controlled	.19	.65	.02
Percentage of variance explained by each factor		29 %	17 %	11 %

The three factors were interpreted by means of the scales with the highest loadings in each factor. The factors seemed to agree closely with those found by other authors in similar research work (Osgood, 1957;

Gray and Wheeler, 1967; Wedin, 1972; Crozier, 1974). As our first two factors were most similar to those found by Wedin, we have chosen to label them in accordance with his terminology.

Factor I, interpreted as TENSION-RELAXATION, has its highest loadings in the following scales: 13 Tense-relaxed, 12 Violent-peaceful, 10 Soft-hard and 9 Threatening-enticing. Factor II, GAIETY-GLOOM, is characterised by high loadings in the scales: 4 Happy-sad, 19 Serious-humorous, 20 Impulsive-controlled and 1 Active-passive. Factor III had its highest loadings in the scales 6 Poor-rich, 8 Beautiful-disgusting, 11 Profound-superficial and 7 Clear-diffuse. It was therefore called ATTRACTION-REPULSION. This factor evidently corresponds to the evaluating factor in Osgood's 1957 research. On the other hand this factor differs somewhat from Wedin's third factor, which he labels SOLEMNITY-TRIVIALITY. The difference is probably due to Wedin using several well-known compositions of a religious and solemn character. In contrast to the first two factors, which are evidently bipolar, Factor III seems to show a tendency towards unipolarity. Wedin (1972) reports the same result and remarks that special pieces of music had to be chosen to obtain bipolarity of this factor.

The ratings of the four scales with the highest loadings were summed to obtain a factor score for each factor. The description of the 13 pieces of music, by means of the factor scores, were then analyzed in the light of the composer's description and the ratings of musico-technical aspects.

Correlations were computed between the mean factor scores of the 13 compositions and ratings of the nine musico-technical aspects. TENSION correlated significantly with dissonant harmony, lack of melody and minor modality; GAIETY correlated significantly

with fast tempo, discontinuity (staccato) and marked rhythm; ATTRACTION correlated significantly only with unsophisticated rhythmic articulation. These correlations are mentioned to support the interpretation of factors and the proposed labelling and they will be subjected to further analysis elsewhere.

DISCUSSION

The results show that the emotional expression in specially composed, short and relatively simple pieces of orchestral music can be analyzed by means of the semantic differential technique. The resulting three dimensions are consistent with those found in other studies and essentially coincide with emotional dimensions obtained by other authors (Iwata, 1972; Wedin, 1972; Crozier, 1974). Furthermore, the positions of the 13 compositions on the dimensions, i. e. their description in factor scores, correspond fairly well with the verbal description of the composer's intentions.

As an example piece no. XI is particularly revealing. The composition consists of a simple homophonal consonating cadence. The orchestra was told to play it in a gentle, soft and natural way. The musically educated raters described the piece as the most consonant, melodious and rhythmically unsophisticated piece with the slowest tempo and highest continuity (legato) of all the pieces. The factor scores of the piece show extreme values in all three dimensions. This means that the subjects experienced the composition as the most relaxed, gloomy and attractive one of all pieces of music in the sample.

S T U D Y I I

Study I showed that emotional experience of music can be described with the aid of semantic differen-

tial. The pieces of music can in turn be qualitatively described by their position in the factorial space designed by mean factor scores. Individual experiences deviate from each of these mean positions to a varying extent. In all probability there are several different underlying factors behind this variability. Our intention in Study II was to investigate the possible influence of sex, age and personality. Other authors have studied related problems.

Watson (1942) asked schoolchildren, college students, graduates and expert musicians to rate musical excerpts on check lists. He found that approximately the same meaning was attributed to music at all age levels with a growth in general ability to discriminate between meanings and appreciation of certain groups of meanings with age. This growth was in the direction of the ratings made by expert musicians. Cattell (1954) applied factor analysis in order to assess the influence of various traits of personality on preference of music. The IPAT music preference test constructed on the basis of this and related studies has, however, been very rarely used, and its diagnostic value has been questioned (Healey, 1973). Keston and Pinto (1955) studied the influence of, for example, sex, age and some personality traits on aesthetic preference of classical music over popular music. The authors claimed that sex and age were negligible factors and of the personality factors used only intellectual introversion (analytical thinking) was found to influence musical preference significantly. In our opinion, the published correlation coefficient between age and musical preference indicates a significant relation. The older subjects seemed to prefer classical music.

Sopchak (1955) investigated the influence of sex, mood and other variables on the response to music. He concluded that there were wide differences among

subjects' ratings of the emotion being expressed in the 15 examples of classical, popular and folk music used. Therefore he states that music cannot without qualification be said to be the language of the emotions. The response to music depends upon learning, mood of the listener, the music style, familiarity and projection of emotions into the music. The influence of sex upon the emotional experience of music was not considered to be important. However, the results of Sopchak's study seem to provide much evidence for a complex influence of the variables investigated. Ratings of certain pieces of music then seem to be relatively independent of familiarity, training, etc. In spite of the author's conclusions quite obvious sex differences are described, e. g. in ratings of classical music. Some doubt could also be claimed about the author's use of "numbers of answers" as a measure of emotionality, because this could be interpreted in many other ways.

Hart and Cogan (1973) studied the influence on emotional responses to classical music and found that women report more positive responses to music than do men. However, there seems to be an interaction between sex and familiarity with music. Men with low familiarity report more positive responses whereas women with low familiarity reported fewer positive responses.

Bragg and Crozier (1974) used semantic differential in order to study the relation of uncertainly level of experimental melodies to emotional perception. A factor analysis of the scales was considered to reflect the three factors ACTIVITY, EVALUATION and POTENCY as defined by Osgood et al. (1957). Young subjects (eight years of age) found less complex music more beautiful, pleasing and interesting, i. e. they differed from adults in scales that were considered to reflect EVALUATION and ACTIVITY. No age

differences were found in scales related to the POTENCY factor. The ratings of eight-year-old subjects were found to be more uni-dimensional and most of the variance appeared in scales related to the EVALUATION factor. Further studies were carried out with preference choices and time of listening as measures. No age differences were found in these experiments and the conclusion was drawn that the difference in the ratings of sound sequences were due to differential use of language rather than to differences in preference as reflected by non-verbal measures.

SUBJECTS

A new sample of 50 subjects without special interest or education in music was used. Twenty-one of them were men from 19 to 51 years of age ($m = 28.4$) and 29 women from 20 to 40 years of age ($m = 27.3$). At the time of the investigation all subjects were free from signs of psychic insufficiency, and had to our knowledge no previous symptoms of psychic illness. Neither had any of them at the time a somatic disease or occupational incapacity.

METHOD

From the previously described 13 pieces of music, seven were chosen for this study. Those six pieces of music were excluded which in Study I were rated as more neutral, i. e. near the mean factor score, in at least two of the factors. In pp. 37-39 the seven pieces of music of Study II are marked with Arabic numbers in the order in which they were used. The subjects rated each piece of music by means of the scales in the semantic differential described above. As in Study I four scales represented each of the three factors of emotional experience. The same instruction for the ratings was used, and the music was presented in the same way as in Study I.

Personality traits were assessed by Cesarec-Marke's Personality Scheme (CMPS) (Cesarec and Marke, 1968). The questionnaire consisting of 165 Yes/No questions is intended to measure 11 psychogenic needs derived from Murray's theory of personality (Murray, 1938). The measured needs are:

1. Achievement: need to accomplish something difficult, to surpass others.
2. Affiliation: need to please and win affection of cathected objects, to adhere and remain loyal to friends.
3. Aggression: need to revenge an injury, impulsive aggression and irritability.
4. Defence of status: need to maintain self-esteem by support of others.
5. Guilt feelings: guilt feelings and super-ego conflicts.
6. Dominance: need to dominate and lead others, to master and control.
7. Exhibition: need to be the centre of attention, to excite, shock and amuse.
8. Authonomy: need to be independent and free, to defy conventions.
9. Nurturance: need to help and take care of others.
10. Order: need for order, cleanliness and planning.
11. Succourance: need to be helped, supported and consoled.

In addition, five weighted factor indices based on factor analysis can be calculated. The indices, which can be seen as measures of somewhat broader personality dimensions, are:

- I. Neurotic self-assertion.
- II. Dominance (rational dominance).
- III. Aggressive non-conformity.
- IV. Passive dependence.
- V. Sociability.

The questionnaire seems to satisfy conventional requirements as to homogeneity and reliability both for the subscales and for the factor indices (Cesarec and Marke, 1968). It has been widely used by different authors on both normal subjects and clinical samples (Bengtsson, 1973; Bliding, 1974; Hellström, 1973; Jacobsson, 1975; Sandberg, 1974), with results which confirmed its validity.

The subjects' scores of the 11 psychogenic needs and the five indices of personality were ranked and the subjects were divided into a high and a low group by means of the medians in each of the variables.

In these high and low groups analysis of variance was applied to the ratings of emotional meaning of music.

RESULTS

In order to examine the possible influence of sex and age on the emotional perception of music the subjects were separated into men and women and by means of the age medians in a younger and an older group. The analysis of variance shows a significant difference ($p < .001$) between men and women in the ratings of TENSION-RELAXATION (Factor I) (Fig. 1). Women experience more tension in music. The differences between the sexes is most pronounced for those pieces of music (5, 4, 1, 2) which are generally rated as more tense, and therefore interaction between sex and pieces of music is also significant. No significant differences between the sexes are noted for Factor II (GAIETY-GLOOM) or Factor III (ATTRACTION-REPULSION).

The analysis of variance of the scores in the age groups reveals no differences in Factor I and II but a significant difference in the experience of

ATTRACTION-REPULSION (Factor III). Older subjects experience the music as more attractive than younger ones. The difference in the attractiveness experienced is approximately equal for all pieces of music and the interaction of age x pieces of music is not significant.

For the purpose of controlling the influences of sex and age the factor scores in high and low groups for the different personality traits were compared by means of a four-way analysis of variance in Factor I and Factor III. An ordinary three-way analysis of variance was, however, applied to the scores of GAIETY-GLOOM (Factor II).

Table II. Analysis of variance of experience of TENSION-RELAXATION (Factor I) in music between men and women with high or low scores on different personality traits. (The figures represent F-values.)

		Between Groups	Interaction Sex x Trait	Interaction Trait x Piece of Music	Interaction Sex x Trait x Piece of Music
Needs:	1. Ach.	1.51	.97	1.33	.40
	2. Aff.	3.57	.09	1.28	.23
	3. Agg.	.00	1.76	.44	.63
	4. D.st.	.24	.20	.64	1.86
	5. Gui.	.00	.06	.60	.89
	6. Dom.	1.24	.17	1.36	1.70
	7. Exh.	.69	.19	.82	.59
	8. Aut.	.01	.44	.29	.63
	9. Nur.	.58	.01	1.54	2.90**
	10. Ord.	.24	.15	.84	1.83
	11. Suc.	2.29	.08	1.04	.45
	I.Neur.self-ass.	1.73	.52	.50	1.04
	II.Dominance	1.09	1.85	2.52*	2.27*
	III.Agg.non-conf.	2.01	.28	1.53	2.23*
	IV.Pass.dep.	1.61	.03	.63	.79
	V.Sociability	2.24	.35	1.29	2.69*

* $p < .05$ ** $p < .01$

Regarding the direction of differences, see text and figures.

Factor I: As shown in Table II the analysis of variance for Factor I gives no significant differences between individuals who score high or low in the various personality traits. The difference between high and low groups on need affiliation is almost statistically significant ($p < .07$). Subjects with a low need of companionship and friendship experience the music as more relaxed. From the simple interactions it can be seen that the dimension dominance x piece of music is significant ($p < .02$). Triple interactions between sex, personality traits and piece of music are significant for the need nurturance ($p < .01$) and the dimensions of dominance ($p < .05$), aggressive non-conformity ($p < .05$) and sociability ($p < .02$). The experience of TENSION-RELAXATION seems in these cases to depend partly on the piece of music, partly on the sex of the subjects and partly on personality traits.

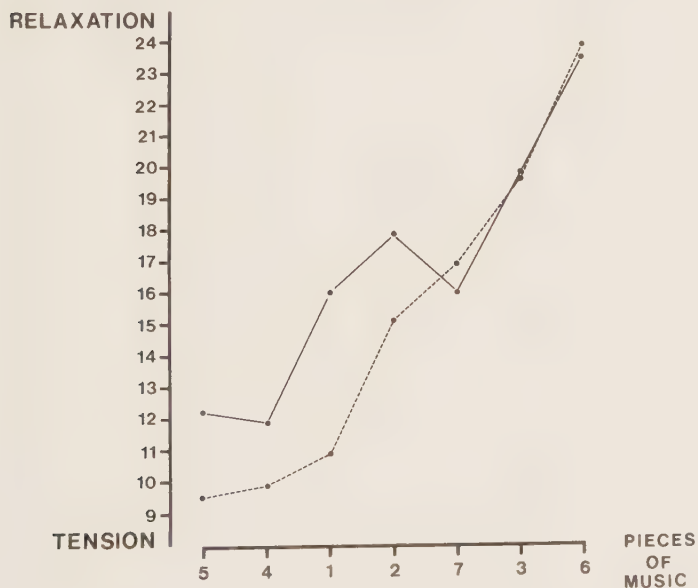


Fig. 1. Mean ratings of TENSION-RELAXATION in seven pieces of music by men ($n=21$, solid line) and women ($n=29$, broken line). The pieces of music are ordered according to increasing scores in Factor I.

Factor II: Two psychogenic needs, defence of status ($p < .02$) and dominance ($p < .05$), seem to be of importance for the experience of GAIETY-GLOOM in the music (Factor II) (Table III). Individuals with low need for defence of status and those with high need dominance experienced the music as more happy, humorous, impulsive and active. The differences in experience is about equal for all pieces of music. The variables of need achievement ($p < .05$) and need autonomy ($p < .05$) had a significant interaction with the pieces of music. Individuals with high need achievement and those with high need autonomy tend to experience GAIETY and GLOOM in the music in a less extreme way. These individuals experience less GAIETY in the pieces of music that are generally

Table III. Analysis of variance of experience of GAIETY-GLOOM (Factor II) in music between subjects with high and low scores in different personality traits. (The figures represent F-values.)

	Between Groups	Interaction Trait x Piece of Music
1. Ach.	.07	2.14*
2. Aff.	.06	1.34
3. Agg.	.00	.26
4. D.st.	5.94*	.37
5. Gui.	1.32	.88
6. Dom.	4.87*	1.14
7. Exh.	.02	.79
8. Aut.	.96	2.16*
9. Nur.	.68	.79
10. Ord.	1.03	.77
11. Suc.	.74	.61
I. Neur.self-ass.	.06	1.64
II. Dominance	2.65	.86
III. Agg.non-conf.	.09	1.36
IV. Pass.dep.	.09	1.24
V. Sociability	.38	1.12

* $p < .05$

rated as more gay. They also experienced less GLOOM in the pieces of music which are generally rated as more gloomy.

Factor III: The analysis of variance of experienced attractiveness (Factor III) (Table IV) in the music was performed while the above-mentioned differences of age were kept under control. None of the psychogenic needs studied and only one of the more complex dimensions, neurotic assertion, arrived in the proximity of statistical significance ($p < .07$). Individuals with high neurotic self-assertion experienced the music as less attractive regardless of the kind

Table IV. Analysis of variance of experience of ATTRACTION-REPULSION (Factor III) in music between younger and older subjects with high or low scores in different personality traits. (The figures represent F-values.)

	Between Groups	Interaction Sex x Trait	Interaction Trait x Piece of Music	Interaction Sex x Trait x Piece of Music
Needs:1. Ach.	.54	.00	.86	2.13*
2. Aff.	.00	.56	.59	3.53**
3. Agg.	2.06	.89	1.51	.40
4. D.st.	1.23	6.33*	.33	2.36*
5. Gui.	1.06	.57	1.83	.41
6. Dom.	.11	8.96**	1.39	1.52
7. Exh.	1.06	.52	1.29	1.20
8. Aut.	.73	.19	1.28	1.80
9. Nur.	2.16	.14	2.37*	.99
10. Ord.	.06	3.02	.75	.02
11. Suc.	.45	.02	.56	.64
I.Neur.self-ass.	3.48	1.62	1.04	1.42
II.Dominance	.01	.17	1.12	2.13*
III.Agg.non-conf.	.47	.07	2.04	.79
IV.Pass.dep.	1.67	.45	2.61*	1.71
V.Sociability	1.19	.08	1.41	1.26

* $p < .05$

** $p < .01$

Regarding the direction of differences, see text and figures.

of piece of music presented. The interaction of personality trait x age is significant for need defence of status ($p < .05$) and need dominance ($p < .01$), while the interaction of variable of personality trait x piece of music is significant for need nurturance ($p < .05$) and the dimension passive dependency ($p < .02$). The triple interactions (personality variables x piece of music x age) produce the majority of the significant differences. Need achievement, need affiliation, need defence of status and the dimension of dominance show significant triple interactions.

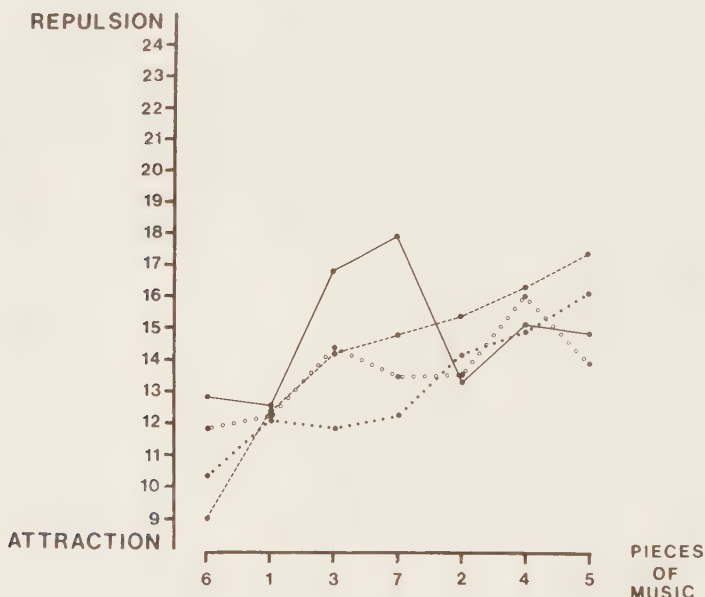


Fig. 2. Mean ratings of ATTRACTION-REPULSION in seven pieces of music by young subjects with low scores on need affiliation ($n = 7$, solid line), older subjects with low scores ($n = 19$, dotted line), young subjects with high scores on need affiliation ($n = 16$, broken line) and by older subjects with high scores ($n = 8$, circles). The pieces of music are ordered according to increasing scores in Factor III.

Older individuals with low need defence of status experienced the music as more attractive and younger individuals with low need dominance experienced it as less attractive than others. Referring to the triple interactions it becomes evident that in the seven pieces of music it is above all in pieces 3 and 7 that the experience of ATTRACTION varies most in the different combinations of the age and personality variable (Fig. 2).

DISCUSSION

The personality of an individual as measured by the CMPS personality scheme and as reflected in differences of sex and age has proved in this study to influence the emotional experience of music much less than might have been expected. Thus very few direct interrelations have been demonstrated between trait of personality and emotional response. The differences found are rarely of high statistical significance. These circumstances taken together make the interpretation of the results difficult. However, those relations that have been brought out could at least be taken as tendencies of some importance and have to be discussed in relation to adequate frames of reference and to previous research.

Differences thus appeared in sex and age. These concepts represent a complex pattern of attitudes, personality characteristics, memories, experiences, etc. Sex was found to contribute to the perception of more tension in women in those pieces of music that connoted more tension to all subjects. A similar sex difference has been noted in semantic behaviour in women (McMillan et al., 1977). They were generally found to use more language that connotes uncertainty, especially in the presence of men. These verbal habits are explained by the authors as a subcultural display consistent with previously found values and

norm emphases of interpersonal sensitivity and emotional expressiveness in women. A similar culturally conditioned sensitivity may explain the difference in the present study of tension perceived.

The observed difference of attractiveness in music related to age may also be attributed to cultural factors. It is reasonable to assume that older subjects find this sample of music more attractive than younger people do. The style of the music is more similar to classical than to popular music. This fact most certainly is one of the reasons for younger people evaluating the music as less attractive. This is consistent with the findings in the study of Keston and Pinto, as we interpret their results. Older subjects were found more often to prefer classical music to popular and folk music than younger subjects.

The relation between personality and emotional experience of music seems to be more direct regarding Factor II. Subjects with low need defence of status and those with high need dominance tend to perceive the music as more gay. These two personality traits may indicate ego strength. Kohut and Levarie treat the role of the ego in connection with the enjoyment of listening to music in the following way (Kohut and Levarie, 1950, p. 72): (in) ... "the unformed ego ... sound is a chaotic threatening experience that cannot be mastered". (Later on in the same page): "Through music a psychological situation is created in which the individual is confronted with a complex, non-verbal influx of auditory stimuli which, essentially, cannot be understood in other terms". Their further reasoning deals with the anxiety created by music listening. The enjoyment is said to be forthcoming as an effect of the liberation of

energy when the anxiety becomes unnecessary because of the intelligibility of the formal aspects of the music.

According to this description, subjects with a weakened ego strength may be supposed to develop greater anxiety by listening to music. The perception of music might then be coloured by this anxiety, and they would experience less gaiety in the music.

Subjects with high need achievement and subjects with high need autonomy tended to avoid extreme ratings in Factor II, GAIETY-GLOOM. These individuals with an intense urge for freedom and with intense needs to compete may well be supposed to avoid too strong an emotional involvement. Why this tendency is limited to Factor II has for the moment to be left without any reasonable explanation. Perhaps Factor II is more purely emotional than the remaining two factors.

Subjects with high need affiliation rated the music as more tense (Factor I) than did those with low need affiliation, especially in those pieces of music rated as more tense by all subjects. The difference (with sex differences controlled) is marked but not statistically significant ($p < .07$). The need affiliation means that the subjects try to obtain affection and friendship, which evidently presupposes the development of a sensitivity to social dynamics. This may explain why the subjects with this need - such as women with their culturally conditioned sensitivity - to a greater extent perceive the increasing tension in music.

Subjects with high neurotic self-assertion rated the music as less attractive at an almost statistically significant level ($p < .07$). Among the characteristics of this personality dimension is the behaviour

dominated by seeking of prestige. A disparaging attitude as a part of this behaviour can be assumed to cause the experience of less attraction.

The triple interactions produce so complex a pattern that the interpretation of them grows more and more difficult. We therefore abstain from elucidating details that are for the present of limited value. One aspect of the general distribution of differences found is, however, well worth noting. It is evident from Tables II and IV that the number of significant deviations increases when all three factors (sex or age, piece of music and personality trait) interact. This finding is an illustration of the way in which music as a message in human communication may be biased. In some of the studies reviewed in the introduction, sex, mood and personality traits were claimed to guide the emotional response to music. However, regarding single personality traits, the results seldom seem to support these hypotheses. Altogether it seems as if the communication of music essentially remains unmodified by the influence of single personality traits. This statement is supported precisely by the existence in the present study of more numerous triple interactions. Almost exclusively in combined action with other factors (sex, age and piece of music), the normal variation of a single personality trait becomes relatively important for the emotional meaning of music.

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PAPER II.

EMOTIONAL EXPERIENCE OF MUSIC AS A FUNCTION OF
MUSICAL STRUCTURE

Sören Nielzén and Zvonimir Cesarec

Department of Psychiatry, University Hospital and
Department of Psychiatric Research, S:t Lars Hospital,
Lund, Sweden

SUMMARY

Ratings by eight musically educated subjects of structural content in 13 excerpts of symphonic music and 13 newly composed orchestral pieces of music were factoranalyzed. Three structural factors emerged which were labelled: SIMPLE-SOPHISTICATED, VIVID-PLACID and DARK-LIGHT. Musically uneducated subjects rated the two samples of music on previously obtained factors of emotional experience: TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION. Factorscores for the structural factors were correlated with factor scores for the factors of emotional experience. Greater sophistication in music led i.a. to the experience of more tension and more vivid elements in the music resulted in the experience of more gaiety. The findings of the quite uniform interpretation of the musical structure support the view that music is an efficient signal in transferring emotional messages.

In all communication the signal that transmits the information is the major determinant of the interpretation of the message by the receiver. When music is used as a signal its form and structural content should have the greatest importance for the experience of the emotional meaning of the message. At the same time different factors within the recipient may influence the experience, but, in comparison with the music as such, certainly to a lesser extent. Factors such as cultural background, musical training, life experience, personality and more occasional, psychological and physical circumstances have a periferal importance as long as these factors vary within normal limits.

An individual element may have different significance when it is by itself or as an integrated part of some musical structure. The constellation of the remaining elements may weaken, reinforce or even totally alter the significance of the element being studied. In Beethoven's Piano Sonata No.12 (Ed.Peters 9452) in A flat major, Opus 26, the minor element in the 2nd movement, "marcia funebre sulla morta d'un Eroo", strongly contributes to the feeling of grief, that the piece of music is intended to describe. The minor element in his Fifth symphony (beginning of the 1st movement) contributes on the other hand more to a feeling of dignity and fateful gravity than to that of grief.

For the study of musical communication it is essential to define the music in a scientific way. Definitions set up by empirically derived practical rules of form, harmony and counterpoint can never satisfy scientific experimental demands (Birkoff, 1932).

The systematisation of the musical content for scientific use has been achieved in various ways. Birkoff proposed a mathematical model of aesthetic appreciation with the formula $M = \frac{O}{C}$ where M = Measure of aesthetic evaluation, O = Order = Regularity of the musical elements and C = Complexity of the musical elements. In his efforts to make his theory practically usable he further investigated harmony, melody and form. In spite of the fact that he postulated additional mathematical formulas to satisfy the many aspects of aesthetic evaluation, these formulas have not been used by other research workers.

Kate Hevner (1936) underlined the necessity of investigating structural elements in the function of music as a whole. In her studies she used parallel versions of a piece of music where she changed only one element at a time. In this way she studied the significance of rhythm, harmony, tonality and structure of the melodic line. Minor and major elements gave the most clearcut results. Major tonality was connected with adjectives describing a happy mood by the subjects and minor tonality with others that were sad and dreamy. Firm rhythm transferred feelings of dignified

and vigorous character and flowing rhythm happy feelings. Simple versus complex harmony gave a more mixed picture where happy and serene feelings were evoked by simple harmony while complex harmony was experienced as exciting, vigorous and sad. Ascending and descending melody gave no clearcut and consistent results. Hevner's method of preparing two versions of a musical composition which differ in one respect only and keeping the element under study in its proper setting is ideal, but very difficult to master. She pointed out that a new melody resulting from the inversion did not always sound sensible or logical and was often unmusical. She had to discard many compositions for this reason. Furthermore, the harmony of the new melody often had to be changed from the original one. The inversion of melodies gave rise to imperfect use of keynote, and could only be made perfect at the beginnings and at the ends of the melodic phrases.

Melvin Rigg (1937) studied experimentally the effect of structural elements in music on 80 psychology students by means of phrases played on the piano. He studied features of music that had been alleged by Eric Sorantin (1932) to evoke certain feelings. The latter had earlier made a classification of the various expressions in numerous compositions in which the intention of the composer was either known or evident from the text or title. Joy was considered to arise from accelerated tempo, ascending fourths

in melody, major mode, simple harmony, staccato notes, forte dynamics or iambic or anapaestic rhythms. Lamentation was considered to arise from the following features: descending minor seconds in melody, minor mode, legato phrasing, dissonance, trochaic rhythms and low register of slow tempo. Similar constellations for sorrowful and hopeful longing and other feelings were proposed, those of love are for instance as follows: dolciata S curve melody (melody oscillating up and downwards) thirds and sixths in treble, major mode, moderate tempo and legato phrasing. Rigg's conclusion was that the features that were proposed to evoke joy and lamentation were statistically significant, while those of longing and love were less certain.

Rigg (1940) also investigated the effect of the alteration of a single element of music on the listener. He studied 5 short musical phrases, three happy in mood and two sad, which were each played at 6 different metronome speeds to 88 observers. It was shown that fast tempo tends to make music happy while slow tempo has the opposite effect.

In an attempt to isolate structural elements determining the aesthetic appreciation of music Henkin (1955) factor analyzed preference ratings of orchestral excerpts of different styles. The factor analysis resulted in three factors that, considering the dominating structures, were interpreted as a melodic factor, a rhythmic factor and an orchestral colour factor.

Vitz (1966) proposed the use of information theory to produce stimulus variation of a melody. Pitch, temporal and loudness levels were constructed which could then be varied for experimental purpose and exactly described by uncertainty ($U = \sum_{i=1}^n p_i \log \frac{1}{p_i}$), where p_i is the probability that the awaited signal will belong to class i . This measure has two properties: it approaches a maximum when all the p_i are equal, and when they are equal it increases with the number of alternative classes to which the signal could belong (Berlyne, 1960). Vitz found that the mean pleasantness ratings increased with increasing complexity if complexity was at a moderate level. When the complexity further increased the rated pleasantness decreased. The point of inflection was at a higher level of complexity for subjects with training and interest in music. His method of calculation of stimulus uncertainty has been used also by Crozier (1974) and the latter comments upon the method: "It should be noted that the uncertainty measure cannot encompass compositional aspects of the sound sequence such as its tonal ("key-centeredness") or metric (rhythmic) qualities. Such conceptual aspects of the stimulus must be resolved outside of the information theory metric". In other words if one wishes to use stimuli which are rather like common music and not composed by aid of any stochastic or "aleatoric" principle the measure does not apply.

Wedin (1972) used a check list and a sorting procedure to obtain judgements in terms of emotional qualities of the experience of 40 musical excerpts. By means of rank correlations and other statistical techniques three dimensions were extracted. They were called Intensity-Softness, Pleasantness-Unpleasantness and Solemnity-Triviality. These dimensions were then related to the stimulus qualities such as tempo, pitch, modality etc. Forte and staccato was associated with Intensity (characterized by adjectives as lively, energetic, agitated etc.), legato and piano with Softness (characterized by soft, peaceful, gentle, dreamy etc.). Consonance, fluent and fast rhythm, major modality and high pitch was connected with Pleasantness (glad, playful, light etc.) and dissonance, firm and slow rhythm, minor mode and low pitch was related to Unpleasantness (dramatic, ominous, fateful, dark i.a.). The existence of major modality, high pitch and staccato in the structure of music was determining the experience of Solemnity (majestic, solemn, dignified etc.) while melody and intensity produced the experience of Triviality (relaxed, popular, merry, commonplace etc.)

Crozier (1974) applied Vitz's method of describing complexity (uncertainty level) of melodic soundsequences, which he exposed to subjects who were asked to complete a semantic differential. Like Vitz he found that scales describing ugliness-beauty, pleasing-displeasing and other scales measuring appreciation were reaching an

apex at a certain degree of complexity and then decreasing again with increasing complexity. This is in accordance with corresponding findings by Berlyne (1974) regarding visual stimuli. Crozier also factor analyzed the semantic differential containing scales both of emotional and structural character and identified the three factors originally demonstrated by Osgood (1957): Evaluation, Activity and Potency. Increasing complexity was found to repeat the earlier mentioned pattern in Evaluation. The factor Activity with high loadings in scales describing consonance, rhythmicalness, variation and rated complexity showed continually increasing values with increasing structural complexity (uncertainty) of the stimulus. No significant relationships were found between complexity (uncertainty) of the stimulus. No significant relationships were found between complexity (U) of a melody and the factor called Potency.

Imberty (1974) studied the emotional response to excerpts of music by Debussy by means of dimensional analysis (*analyse factorielle des correspondances*) of adjectives spontaneously associated by the subjects to the excerpt in question. His way of analyzing the musical stimulus for the purpose of comparison with the emotional responses took a start in Berlyne's (1960) point of view and in theory of communication. He refined various aspects of the analysis and constructed mathematical expressions of structure or style. Finally one index of formal complexity and one

index of dynamism were defined. The index of formal complexity was composed of one coefficient of homogeneity ($(H_m \times t)$ where H_m is the entropy of melody and t the duration of formal metric interval) and one coefficient of dissimilarity ($(eI \times eR)$ where eI is the average deviation of "subjective intensity" and eR the average deviation of the duration of the notes of the excerpt). Complexity then was defined as the sum of these coefficients, thus $C = (H_m \times t) + (eI \times eR)$. The index of dynamism was defined as $D = I \times V$ where I is the "subjective intensity"¹ (this time not the average deviation but the absolute value) and V the speed of the average number of notes per time unit. High formal complexity was found to be related to responses of a melancholic or sorrow mood. High complexity combined with high dynamism was related to anxiety and aggressiveness. Low complexity combined with medium dynamism was related to responses of joy and wellbeing. Imberty's investigations are very interesting as they offer an example of a possibility to handle the difficult stimulus that a piece of music constitutes in the experimental situation. This difficulty is exemplified by the studies by Gabrielson (see Bengtsson and Gabrielsson, 1977) dealing with the perception of rhythm in musical excerpts. By means of multivariate statistics he was able to isolate at

¹"Subjective intensity" constitutes a measure of the total impact of sound defined by several components as quietness and loudness, big or small musical intervals, degree of consonance in the musical interval, degree of strangeness of harmony, the existence of chromatic trills and so forth.

least fifteen different verbal factors describing only the rhythmical aspect of musical stimuli.

Günter Batel (1976) applied cluster analysis in a trial to define the components determining the experience of music. The analysis of adjective check-lists that had been completed during music listening resulted in the following main clusters: order, unfamiliarity, temperament, feeling (Empfindung) and clarity (Prägnanz). The adjectives that were used were not confined to any specific aspect of experience, many of them described structures or attitudes. Even if these clusters seem to be somewhat peculiar there is a possibility of comparison with important groupings in other studies. Order and familiarity may thus have a connection with some aspects of complexity as it had been used for instance by Imberty, Crozier and others. Temperament and feeling may on the other hand be related to Imberty's concept dynamism, which contains i.a. quietness and loudness, tempo, impact of sound etc.

The aim of the present study was to further explore relations between structure in music and emotional experience. The main interest was focused upon real music as opposed to tones, rhythm patterns, computerized melodies etc. A basic assumption was that emotional experience of music depends on constellations of structural elements rather than on separate single elements. Therefore ratings of single elements were

factor analyzed in order to isolate coherent groups of elements. Factors of this kind may then be compared with measures of emotional experience. A measure of emotional experience has been constructed and used in earlier studies (Nielzén and Cesarec, 1981).

METHODS

As stimuli two samples of music were used. One sample was newly composed and described elsewhere (Nielzén and Cesarec, 1981). To obtain a greater span of expressivity in the stimulus and a reference sample for comparisons the second sample included excerpts from classical symphonic music. The classical sample was thus collected with regard to as broad a variation of structural elements and musical style as possible. Therefore compositions from Bach to Maderna and Blomdahl were incorporated in the sample. It is presented below:

1. Wagner, Richard: Overture to The Flying Dutchman. Measures 1 to 22. Duration 25 sec. Record: Philips 6747,248; 3 LP live from the Bayreuth Festspiele. Conductor: Wolfgang Savallisch. The music is violent, and all the force of the complete symphony orchestra is used. The

theme is very clear and imposing. Heavy scales simulate a thunderstorm.

2. Schumann, Robert: Symphony no. 3, 1st movement. Measures 25 to 55. Duration 28 sec. Record: Deutsche Grammophon 138908, ST33, SLPM. Berlin Philharmonic Orchestra under Raphael Kubelik. This music is very melodious with a fluent tempo and impressive, rich orchestration. The mood is neither sorrowful nor joyous but gives a feeling of secure balance.

3. Bach, Johann S.: Fourth Brandenburg Concerto, 2nd movement. Measures 1 to 9. Duration 25 sec. Record: Archiv 14242. Conductor: Rudolf Baumgartner. The Andante is very calm, harmonious and mild. It has a serious and solemn character.

4. Bach, Johann S.: Sixth Brandenburg Concerto, 1st movement. Measures 1 to 15. Duration 25 sec. Record: Archiv 14242, Festival Strings Lucerne. The music is composed for violas

and bassinstruments. This gives the music a heavy character which is underlined by a very stable monotonous rhythm.

5. Blomdahl, K.-B.: Forma Ferritonans. Measures 34 to 40 from the beginning. Duration 30 sec. Record: Riks LP2:2, Expo Norr 1965. Stockholm Philharmonic Orchestra under Sergiu Commissiona. The work simulates the sound in a great ironworks with both high and low pitches and very intensive, almost painful, coherence. A tension is continually built up in this part of the piece of music.

6. Kodály, Zoltán: Dances from Galánta. Measures 190 to 205 from the beginning. Duration 20 sec. Same record as no. 5 above. This part of the composition is a short bridge passage with an airy atmosphere due to the timbre of flutes and oboes.

7. Liszt, Franz: Les Préludes. Measures 131 to 146. Duration 23 sec. Record: Qualiton LPX 11341-a. Conductor:

Nemeth Gyula. A magnificent example of orchestral tutti in a romantic style. A firm melodic line exists, the harmonic foundation is solid, the formal development is logical and the instrumentation covers the complete spectrum of instruments.

8. Maderna, Bruno: Serenata. Duration 46 sec. Score not available, no measures can be pointed out. Record: Time 58:002, M90 P, 4847. English Chamber Orchestra under Bruno Maderna. Thin, brittle structures at the extreme ends of the possible expressive capacity of the instruments are used. The form is not supported by clear rhythm or other stable elements, thus big intervals and sudden subtle discrete changes demand a high level of attention from the listener.

9. Ravel, Maurice: La Valse (no. 86-92 in La Valse, Partition de Poche, Durand et Compagnie 1956). Duration 28 sec. Record: London Longplaying, CM 9119. Conductor: Ernest

Ansermet. This part of the Valse contains a very marked intensification by all means of composition in the direction of greater force. The sample ends up in an almost delirious violence.

10. Ravel, Maurice: Boléro. Measures 145 to 156.
Duration 30 sec. Record: London Longplaying, CM 9119. Conductor: Ernest Ansermet. This part of the Boléro gives a rather calm feeling with its rhythmical and harmonic stability. The prominent main theme is executed by the soprano saxophone.

11. Krenek, Ernst: Symphonie Elégiaque, 1st movement. Measures cannot be pointed out, score not available.
Duration 27 sec. Record: Philips modern music series, A 01495.
Conductor: Dimitri Mitropoulos. The music is conceived in twelve-tone style and the excerpt can be described as an example of advanced modern music with complex and sophisticated means of expression.

12. Bartók, Béla: Divertimento for Strings and Percussion, 2nd movement, allegro. Measures 1 to 22. Duration 33 sec. Record: Columbia Sax 2432. Conductor: Herbert von Karajan. In this excerpt, a dramatic suggestive power prevails. A complicated and interesting melody is supported by a stable rhythmic basis.
13. Debussy, Claude: La Mer (mark 40-42 in La Mer, Partition de Poche, Durand et Compagnie, 1905). Duration 37 sec. Record: Seraphim 60077. Conductor: Guido Cantelli. These 25 last measures of "Jeux de vagues", certainly symbolizing the calm mirror of the water, are a soft piece of music. A beautiful melody is intonated in the oboe part.

Rating of musical content.

Both samples of pieces of music were rated by eight musically educated persons. The ratings were performed on two different occasions; the sample of newly composed music in one session and the sample of

classical music in a later one. The rating scale contained 5 categories for the following musicotechnical aspects:

- A - Harmony (dissonant - consonant)
- B - Modality (major - minor)
- C - Melody (melodious - amelodious)
- D - Intensity (pianissimo - fortissimo)
- E - Pitch (bass - treble)
- F - Rhythm (marked - vague)
- G - Rhythmic articulation
(sophisticated - unsophisticated)
- H - Continuity (staccato - legato)
- I - Tempo (fast - slow)

Intercorrelations between the ratings of the 9 structural elements were computed and some meaningful clusters of the elements could be discerned. Therefore the intercorrelations were factor analyzed by means of principal factoring with iteration and subsequent Varimax rotation (Nie et al., 1975).

Semantic scales.

The emotional experience of the two samples of music was assessed by means of the semantic differential (Osgood et al., 1957). In an earlier study (Nielzén and Cesarec, 1981) three factors of emotional experience were found. To measure each factor, factor scores are calculated by addition of the subject's

ratings on the four scales with the highest loadings in the factor. Factor I, which is called TENSION-RELAXATION, is measured by the scales Tense - relaxed, Violent - peaceful, Hard - soft and Threatening - enticing. Scales Happy - sad, Humorous - serious, Impulsive - controlled and Active - passive measure factor II called GAIETY-GLOOM. Factor III, labelled ATTRACTION-REPULSION, is measured by the scales Rich - poor, Beautiful - disgusting, Profound - superficial and Clear - diffuse.

The same practical arrangements and procedure were used both for the rating of musicotechnical content and for the rating of emotional experience. The music was played from a stereophonic tape recorder and was listened to through loudspeakers at a subjectively pleasant volume. The newly composed pieces of music had been recorded in a studio by a small symphonic orchestra (for more detailed description see Nielzén and Cesarec, 1981). The sample of classical music was recorded from commercial records on stereophonic tape in the earlier described order. The subjects were comfortably seated in a semi-soundproof room.

When rating the musicotechnical content the rater immediately filled in the form with the 9 rating scales after having listened to a piece of music. When rating the emotional experience the listener was instructed to rate the experience evoked by the music. The

subjects were exposed to one piece of music at a time and the rating was performed after each presentation.

SUBJECTS

Twenty-five students, 21 women and 4 men between 20 and 40 years of age, rated the emotional experience of the sample of classical music. The newly composed pieces of music were rated by 50 students, 28 women and 22 men between 20 and 30 years of age.

All subjects in the two groups had normal hearing acuity and no special interest in music. None of them showed any signs of psychic decompensation and they were not known to have been suffering from any mental illness earlier in life.

RESULTS

The factor matrices from the ratings of the musico-technical variables in the two samples of music are presented in Table I. Two factors appear in the sample of classical music and a corresponding pair of factors in that of newly composed music. The first factor has the highest loadings in the following variables: harmony, modality, melody and rhythmic articulation.

One pole of the first factor is then characterized by dissonance, minor modality, poorly developed melody and sophisticated rhythmic articulation and the

Table I

Rotated factor matrix of the ratings of structural elements in classical music (A) and in newly composed music (B)

	I	II	
A. Harmony (dissonant - consonant)	<u>-.86</u>	.07	
Modality (major - minor)	<u>.60</u>	.43	
Melody (melodious - amelodious)	<u>.82</u>	.11	
Intensity (pianissimo - fortissimo)	.30	<u>-.69</u>	
Pitch (bass - treble)	-.25	.71	
Rhythm (marked - vague)	.54	<u>.78</u>	
Rhythmic articulation (sophisticated - unsophisticated)	<u>-.94</u>	.08	
Continuity (staccato - legato)	.31	<u>.81</u>	
Tempo (fast - slow)	.22	<u>.92</u>	
	I	II	III
B. Harmony (dissonant - consonant)	<u>.84</u>	.28	.23
Modality (major - minor)	<u>-.76</u>	.22	<u>-.43</u>
Melody (melodious - amelodious)	<u>-.92</u>	-.23	.01
Intensity (pianissimo - fortissimo)	-.01	<u>-.75</u>	.09
Pitch (bass - treble)	.09	-.05	<u>.93</u>
Rhythm (marked - vague)	-.24	<u>.89</u>	.25
Rhythmic articulation (sophisticated - unsophisticated)	<u>.96</u>	-.14	-.23
Continuity (staccato - legato)	.19	<u>.88</u>	.00
Tempo (fast - slow)	.19	<u>.85</u>	-.22

opposite pole by consonance, major modality, well developed melody and unsophisticated rhythmic articulation. Considering these opposites and with regard to the fact that both music samples represent a "classical" style in contrast to pop, jazz and so on the factor was labelled SIMPLE-SOPHISTICATED.

The second factor has its highest loadings in the following variables: intensity, rhythm continuity and tempo. The two poles of this factor are low intensity (pp), vague rhythm, legato and slow tempo contra high

high intensity (ff), marked rhythm, staccato and fast tempo. Considering the meaning of these variables in the musical context this factor was labelled VIVID-PLACID.

The factor analysis of the ratings of the newly composed music also results in a third factor with loadings in modality and pitch. It evidently reflects the raters recognition of the degree of brightness and it was labelled DARK-LIGHT.

For each of the first two structural factors common to the both samples of music the four scales with the highest loadings were chosen to calculate factor scores. As weighting did not result in any change of results, simple adding of the scales was preferred. In the same way factor scores for the third structural factor were calculated by adding the two most loaded scales.

By means of factor scores the position of a piece of music in factor space - its expressive style - can be defined and the pieces can be compared with each other. Factor scores of the two samples are presented in Table II. From this table can be seen that the structurally most unsophisticated extracts of music are Wagner's Flying Dutchman (1), Schumann's symphony (2), Bach's Brandenburger concerts (3,4), Kodály's dances (6) and Ravel's Bolero (10). The most structurally sophisticated pieces of music are Blomdahl's Forma

Table II

Factor scores for the structural factors in the two samples of music.

Sample of classical excerpts			Sample of newly composed music			
	SIMPLE - SOPHISTICATED	VIVID - PLACID		SIMPLE - SOPHISTICATED	VIVID - PLACID	DARK - LIGHT
1	7.50	7.34		9.76	8.38	5.00
2	6.17	11.00		15.50	13.26	4.63
3	7.33	17.00		12.00	10.38	6.50
4	7.99	8.84		8.50	7.50	7.25
5	17.50	16.00		13.38	8.13	5.87
6	5.87	9.67		13.62	9.01	7.12
7	10.16	7.00		13.37	9.13	7.25
8	13.67	14.17		10.38	11.50	6.62
9	12.67	7.66		14.62	9.21	5.62
10	8.34	9.33		14.37	12.76	5.37
11	15.83	14.17		6.12	16.25	7.37
12	13.17	7.00		8.87	14.13	6.75
13	10.84	17.50		7.88	6.26	7.50
m	10.54	11.28		11.41	10.45	6.37
s	1.04	1.09		.83	.82	.27

Ferritonans (5) and Krenek's *Symphonie Elégiaque* (11). The most vivid ones are Wagner's *Flying Dutchman* (1), Liszt's *Les Préludes* (7) and Bartók's *Divertimento* (12), while the most placid ones are the *Andante* of the 4th *Brandenburger concerto* (3) and *la Mer* by Debussy (13). From the table can further be seen that the two samples differ in variation (over all standard deviations smaller in the newly composed music) and differentiation of expressive means (an independent factor of orchestral brightness appeared in the newly composed music).

Correlations between scores of the structural factors and scores of factors of emotional experience are presented in Table III. The experiential factor TENSION-RELAXATION shows in both samples of music, statistically significant negative correlation with the structural factor SIMPLE-SOPHISTICATED. In both samples of music tension then increases with dissonance, minor modality, lack of melody and sophisticated rhythmic articulation. The experiential factor GAIETY-GLOOM correlates significantly with the structural factor PLACID-VIVID. In both samples of music, gaiety is perceived in association with high intensity (ff), marked rhythm, staccato and fast tempo. The factor ATTRACTION-REPULSION is in the sample of classical music significantly correlated with the dimension SIMPLE-SOPHISTICATED. Consonance, major modality, well-developed melody and unsophisticated rhythm are perceived as more attractive in the sample of classical music. The corresponding correlation in the sample of newly composed music is not significant.

The structural factor DARK-LIGHT does not show any significant correlations with any of the experiential factors. The highest correlation is found with TENSION-RELAXATION. In the sample of newly composed music major modality and treble pitch tend to relate to experience of RELAXATION.

Another conspicuous difference between the classical sample and the sample of newly composed music turns

Table III

Correlation coefficients between factor scores of the rated emotional experience and scores of the structural factors in the two samples of music

Dimensions of musical structure		SIMPLE-SOPHISTICATED		VIVID-PLACID		DARK-LIGHT	
		consonant - dissonant		fortissimo - pianissimo		minor - major	
scales		major - minor		marked - vague		bass - treble	
		melodious - amelodious		staccato - legato			
		unsophist. - sophist.		fast - slow			
Factors of emotional experience		Class.	Newly composed	Class.	Newly composed	Class.	Newly composed
TENSION-RELAXATION							
tense - relaxed							
violent - peaceful							
hard - soft							
threaten. - entic.							
scales		-.60*	-.63*	.35	.45	-	.51
GAITY-GLOOM							
happy - sad							
humorous - serious							
impulsive - controlled							
active - passive							
scales		.46	-.02	.73**	.80***	-	-.31
ATTRACTION-REPULSION							
rich - poor							
beautiful - disgusting							
profound - superficial							
clear - diffuse							
scales		.79*	.45	.35	-.27	-	.00

* p < .05

** p < .01

*** p < .001

out in the correlation between the experiential factor ATTRACTION-REPULSION and the structural factor VIVID-PLACID. These correlations are not significant per se, but they differ significantly from each other ($z = 1.96$, $p < .05$). In the sample of classical music ATTRACTION is slightly associated with forte of intensity, marked rhythm, staccato, continuity and fast tempo, while in the newly composed sample these structural traits are rather related to REPULSION.

DISCUSSION

The appearance of two common structural factors in both samples of music means a possibility to get a scientific description and quantification of musical expressive style. The findings also imply that composers systematically use several single structural elements together with each other in order to create an expression in music. Of course expressions in music can be created with other means. One single element may carry a dominating expression for itself or contribute to expressions within the realm of other structural constellations. The findings by Henkin (1955) are almost identical as to the structural factors in spite of his using a different method. Possibly even the results in Batel's (1976) study may be compared with those in the present one. Thus order and familiarity seem to be related to SIMPLE-SOPHISTICATED, feeling and temperament to VIVID-PLACID and clarity may share a component with DARK-LIGHT.

The structural factor SIMPLE-SOPHISTICATED was negatively correlated with the experiential factor TENSION-RELAXATION. This finding is in spite of various differences mainly in accordance with those by Wedin (1972) who found that a pole of an experiential factor consisting of adjectives like dramatic, ominous, fateful, dark, doleful was associated with musico-technical content of dissonance, firm and slow rhythm, minor mode and low pitch. Imberty (1974) also found that harmonic and melodic relations ($I = \text{intensité}$) comparable to the present pole SOPHISTICATED were associated with responses as hard, violent, aggressive, firm (*dur, violent, agressif, décidé*), which correspond to the present pole TENSION.

Positive correlation exist between the structural factor SIMPLE-SOPHISTICATED and the experiential factor ATTRACTION-REPULSION. As shown by many authors (Vitz, 1966; Crozier, 1974) a rising complexity above an optimum point leads to ratings of greater repulsion in musical contexts. The reason why this correlation is not significant in the sample of newly composed music may be that here the variation in structure is somewhat smaller than in the sample of classical music representing many different composers.

The structural factor labelled VIVID-PLACID correlated highly significantly with the experiential factor GAIETY-GLOOM. Of all relations between stimulus and response in music this one seems to be the one most

commonly demonstrated. Hevner (1936) thus found that firm and flowing rhythm transfers feelings of dignified, vigorous and happy character. Rigg (1937) concluded that joy in music arises i.a. from forte dynamics, accelerated tempo and staccato notes. Wedin (1972) also demonstrated that forte and staccato was related to lively and agitated experiences and similarly Imberty (1974) got results showing that medium dynamism i.e. forte and fast tempo etc. gave responses of joy and well-being in the absence of simultaneous high complexity.

In the sample of newly composed music the factor VIVID-PLACID seems to be split in two factors. Pitch and modality does not co-vary with vividness but constitutes a separate factor (DARK-LIGHT). A possible explanation of the splitting may lie in the fact that the newly composed music is the work of only one person. In composing, a single individual applies partly common expressive means determined by his socio-cultural environment, partly more idiosyncratic combinations of structural elements. When samples of compositions by several composers are analyzed common and general traits become emphasized while personal expressive styles become neglected.

The third experiential factor ATTRACTION-REPULSION was correlated in opposite directions with the factor VIVID-PLACID in the two samples. While vividness in classical music is experienced as attractive it has

a contrary effect on the listener to the newly composed sample in which placidity is associated with attractive feelings instead. This difference is explained by interactions of stylistic elements in the two samples. When music is composed for experimental aims it might be more comparable to "experimental" music in the classical sample exemplified by Maderna, Blomdahl and Krenek and a great vividness in this kind of music may be experienced as more complex and unpleasant. In the more traditional classical style which dominates the classical sample vividness instead often means easiness and simplicity, which may be associated with pleasant feelings.

To sum up the study has shown that factor analysis of ratings of musical content by musically educated raters results in interpretable and meaningful factors of expressive style. These factors are correlated with the emotional experience of musically untrained listeners. The expressive means thus seem to be quite uniformly interpreted by the listeners. The study supports the view that music is an efficient signal in transferring emotional messages.

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STUDY III.

ASPECTS OF TEMPO AND PERCEPTION OF MUSIC IN MANIA

Sören Nielzén, M.D. and Zvonimir Cesarec, Ph.D.

Department of Psychiatry, University Hospital (Head: Professor Rolf Öhman) and Department of Psychiatric Research, S:t Lars Hospital (Head: Professor E. Nyman), Lund, Sweden.

SUMMARY

Ten patients with manic psychosis were compared with 20 normal subjects with respect to their ratings of emotional meaning in music. As stimulus two pieces of music for a small symphony orchestra were used. These were structurally identical but performed at two different tempos: slow and fast. The change in tempo was found to lead to dissimilar consequences in emotional experience in the two groups studied. In normal subjects an increased tempo led to the experience of more tension, while in manic psychotics this was associated with an experience of more gaiety. The pattern of ratings constitutes further evidence that temporal relations are of importance in the psychopathology of mania.

Key words: Mania - psychopathological perception - musical stimuli - temporal perception.

INTRODUCTION

Several investigations have dealt with the expressive means of composition and their evocation of emotional responses in the normal individual. Thus Rigg (1939) and Hevner (1936) noted that tempo, modality, pitch and other characteristics of melodies had specific influences on the perception of for instance gaiety or sadness. As a general tendency they found that firm rhythm and fast tempo make music happy. Imberty (1974) studied the semantic representation of style in music and found that "structural dynamism" was related to responses of tension and relaxation. In his terms a higher level of dynamism included a faster tempo and led to responses of more tension. Vitz (1966) and Crozier (1974) have studied the effect of the degree of complexity in a melody on the emotional experience in normal subjects. They both found that if the degree of complexity was too low or too high, this made the subjects experience the music as less attractive.

In studies of emotional responses in patients with psychiatric symptoms, some results have been obtained with reference i.a. to manic psychosis. Simon et al. (1951) studied schizophrenic, manic and depressive psychotics' and normal subjects' recognition of happy and sad moods in music. Manics made comparatively many misinterpretations of both sad and happy moods. The patients were also asked to rate their liking or disliking of the music. The manic psychotics were found

to like happy music as did all groups. In comparison with the other groups they also showed a considerable liking for sad music which was partly explained by their high frequency of misinterpretation of sad mood. Stein (1977) found that manic patients consistently made errors in imitating very slow and very fast tempo in a test piece of music. The manic patients showed an intolerance for slow music and preferred music in their "optimum tempo". Those patients with impaired tempo response of her sample (N = 7) who received lithium therapy all responded well to this therapy. She raised questions of whether the tempo error reflects the stage of mania and if it is possible to use a musical test to identify likely lithium responders.

There are thus reasons to believe that the experience of expressive qualities in music is disturbed by manic pathology. The aim of the present study is to investigate the perception of emotional meaning in music as a function of slow and fast tempo in a group of manic patients as compared to a normal control group.

SUBJECTS

Ten in-patients with manic psychosis were used as subjects. They showed euphoria, talkativeness, accelerated associations and some degree of psychomotor agitation. They were compared with 20 normal subjects without any symptoms of mental illness or decompensation. The normal sample was as far as possible matched with respect

to age and sex. This was done because an earlier study had shown some differences in the perception of emotional experience in males and females and at different age levels (Nielzén and Cesarec (1982)). The mean age and range of age in the normal group was 35.3 (21 - 51) and in the manic group 40.0 (21 - 67).

The difference between the means of age in the two samples is not significant ($t = 1.02$, N.S.). In the normal group there were 8 males and 12 females and the manic group consisted of 4 males and 6 females.

MATERIAL AND METHODS

A series of 7 new compositions with different expressive qualities were played to the subjects. The compositions are orchestrated for a small symphony orchestra, their durations varying from 10 to 25 seconds. Numbers 3 and 7 of these pieces of music are identical with the exception of tempo. The last one is performed in a rather faster tempo (the beat in No.7 is 120 MM as compared to 94 MM in piece No.3). The compositions were presented through earphones from a tape-recording.

The assessment of emotional experience was accomplished by means of the semantic differential according to Osgood et al. (1957). In an earlier study (Nielzén and Cesarec (1981)) three factors of emotional experience were demonstrated: I. TENSION-RELAXATION, II. GAIETY-GLOOM and III. ATTRACTION-REPULSION. The three

factors were measured by means of the four scales with the highest loadings in one factor and at the same time low loadings in the other two factors. Factor I is measured by the 4 following seven point rating scales: tense - relaxed, violent - peaceful, hard - soft and threatening - enticing; factor II by happy - sad, humorous - serious, impulsive - controlled, active - passive; and factor III by rich - poor, beautiful - disgusting, profound - superficial and clear - diffuse. The rating was made immediately after each presentation of a piece of music. Factor scores are calculated by adding the ratings pertaining to each factor. Consequently, the factor scores may vary from 4 to 28. This study considers only ratings of pieces No. 3 and 7.

In a preliminary study of retest reliability of the factor scores the reliability for the actual pieces of music (No. 3 and 7) was .44, .81, .75 and .45, .68, .66 for the three factors of emotional experience. These figures may be considered as satisfying for group comparisons.

Mean factor scores for the two pieces of music in the two groups were compared by means of t-test.

RESULTS

The mean factor scores are presented in Table I. The slow piece of music was rated by the normal subjects

Table I

Comparison of mean factor scores and t-values between manic and normal subjects and between a slow and a fast piece of music

	I		II		III	
	TENSION-RELAXATION		GALEITY-GLOOM		ATTRACTION-REPULSION	
	Normal	Manic	Normal	Manic	Normal	Manic
Slow	19.1	17.5	9.5	15.7	12.3	15.4
Fast	15.5	16.6	8.9	12.4	13.6	11.7
t	4.33***	.59	1.06	2.40*	1.59	2.19

* p < .05
 ** p < .01
 *** p < .001

as fairly relaxed, very gay and moderately attractive. The manic subjects rated this piece of music as being significantly less gay and less attractive. They rated the slow piece of music also as somewhat less relaxed but the difference is not significant.

The ratings of the fast piece of music are not significantly different in the two groups as regards factors I and III. It is rated as neither relaxed nor tense and as moderately attractive. The control group rated the fast piece of music as very gay and the manic patients as significantly less so.

It is obvious from Table I that nearly all ratings of the fast piece of music have changed in the direction of less relaxation, greater gaiety and greater attraction when compared to the ratings of the slow piece of music. The only exception is the rating by the normal group in factor III where the fast piece of music is rated as somewhat less attractive instead.

The change in the experience of tension caused by the fast tempo is most significant in the control group. In the manic group the change of tempo causes an experience of greater gaiety at a significant level. The change in the third factor is in the direction of greater attraction in the manic group and lies just below the level of significance. A comparison of the differences in ratings of attraction in the manic group with the dif-

ferences in the normal group gives a t-value of 2.62 ($p < .02$).

DISCUSSION

The musical stimulus is somewhat similar to a bourrée in baroque style or a gavotte of the rococo style. It has a rebounding rhythm in 2/4 time and its theme is based on quavers, performed in a staccato manner. The melody is simple, and so are harmony and structure. The change of tempo from the first piece of music to the other is moderate and could be described as a change from allegro to vivace in musical terminology. This moderate change to a faster tempo makes the normal subjects perceive the music as significantly less relaxed. According to Imberty (1974), high musical dynamism and complexity result in the experience of anxiousness and aggressiveness. His definition of dynamism includes tempo (greater number of notes per time unit gives higher dynamism). Factor I, TENSION-RELAXATION, in the present study has some aspects in common with Imberty's "anxiousness" and "aggressiveness". The experience of more tension following increased tempo could be expected in the light of his findings. In the manic group the change of tempo did not alter the experience of tension - relaxation.

However, Rigg's notion of increased gaiety as a result of higher tempo was not confirmed in this study. Normal subjects seem to experience the slow piece of music

as already very gay and the increase of tempo is not sufficient to change this experience to a still higher level. The manic patients experienced the slow piece of music as less gay than did the normal subjects, a difference that is statistically highly significant.

The change of tempo resulted in the manic group in an experience of significantly greater gaiety. However, they also find the fast piece of music less gay than do the normal subjects. Brown (1979) states that 60 - 80 MM could represent an ideal, average or neutral speed of movement with which all others are unconsciously compared. Stein (1977) found that in manic patients the "optimum tempo" varied from 120 MM to over 208 MM with the median "optimum tempo" 152 MM. One may suppose that the manic patients compared tempo in music with their higher "optimum tempo".

Consequently the experience of greater sadness in both pieces of music by the manic group may be due to their incorrect interpretation of tempo. The change of tempo in these pieces of music consists of an acceleration from 95 MM to 120 MM. This small change of tempo does not seem to mean very much to the normal subjects but presumably as it approaches the "optimum tempo" of the manics, it has greater significance for them.

The slower piece of music has a moderate degree of complexity, which according to Vitz (1966) and Crozier (1974) would make the music fairly attractive. The

normal subjects also experienced the music as rather attractive. The manic patients, however, rate the slow piece of music as significantly less attractive. Stein (1977) found that her patients showed an intolerance of slow music. The frustration, which accumulates during listening to a piece of music that is considered to have too slow a tempo may lie behind the lesser attraction experienced by the manic group.

The change to a faster tempo made normal subjects rate music as somewhat less attractive while the manic patients considered the fast piece of music as rather more attractive. Thus the two groups altered their ratings in opposite directions and the difference of rating scores separated the two groups significantly. It seems reasonable that the normal subjects, who experience more tension in the fast piece of music also find it slightly less attractive. In the manic group, on the other hand, the increased tempo results in the experience of greater gaiety and greater attraction.

In conclusion it can be stated that manic patients differ from normal subjects in their perception of several emotional aspects of music. When the tempo is raised the emotional experience of the manic patients is changed in a direction or to a level that is more similar to the experience of normal subjects. One possible interpretation is that these changes are due to the fact that the faster tempo comes closer to the raised "inner optimum tempo" of the manic patients.

Evidently, temporal relations are important in the psychopathology of mania.

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PAPER IV.

EMOTIONAL EXPERIENCE OF MUSIC BY PSYCHIATRIC
PATIENTS COMPARED WITH NORMAL SUBJECTS

Sören Nielzén, M.D. and Zvonimir Cesarec, Ph.D.

Department of Psychiatry, University Hospital (Head:
Professor Rolf Öhman) and Department of Psychiatric
Research, S:t Lars Hospital (Head: Professor E. Nyman),
Lund, Sweden.

ABSTRACT

Psychiatric patients (n = 107) and normal subjects (n = 100) were exposed to 7 newly composed pieces of music orchestrated for a small symphony orchestra. The patients were divided into seven subgroups: schizophrenic, depressive and manic psychosis; and obsessive, depressive, anxiety and hysterical neurosis. All subjects rated the music on semantic differential scales describing three factors of emotional experience: TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION. The ratings by patients in the different groups were compared with those by the normal subjects. Expressiveness in music was found to be communicated to patients in the same relative way as to normals. However, in the various diagnostic groups, several marked differences in experience were demonstrated which seem to be related to general psychopathological factors. Main findings were that schizophrenic psychotics experienced the music as more attractive while depressive and anxiety neurotics experienced it as less attractive than normals. Depressive and manic psychotics experienced the music as less gay. Obsessive neurotics seem to be more sensitive to tension in music than normals.

Key words: mental illness - expression in music - emotional experience.

INTRODUCTION

Disturbance of the emotional communication holds an important place in discussions about etiological and diagnostic aspects of mental dysfunction. Thus it is often noted that neurotic patients inadequately interpret emotional stimuli and that depressive patients experience only the dark tones of the emotional spectrum. The study of communication of music to subjects with mental diseases might produce some elucidatory information as music is in many cases considered to constitute an emotional communication of more or less pure form. In spite of the fact that psychiatric diagnosis relies upon the systematic registration of such experimental distortion, sometimes by means of projective tests, relatively little is as yet known about the effect of mental disturbance on the experience of music.

In investigations studying the experience of music by psychopathological groups the methods and musical stimuli have been considerably varying and therefore the results are difficult to compare. Schizophrenic patients have been claimed to show inadequate recognition and interpretation of sad mood in music in comparison with interpretations by normal and depressive subjects (Simon et al., 1951) and in relation to their stated mood (Biller, 1973). Simon et al., explained the differences in experience as an effect of the impaired ego-functioning in schizophrenic patients. Cattell

and McMichael (1960) found that schizophrenic patients were high on a music preference factor which in turn correlated with a personality factor of introspectiveness.

Depressive psychotics were found to dislike sad music and together with normals to make fewer errors in recognition of sad mood in music (Simon et al., 1951). The authors proposed that the results could be explained by the influence of the prevailing mood in depressives.

The perception of musical time relations and tempo by psychotics, especially manic psychotics, has been shown to be disturbed. Weber (1977) presumes that the disturbance of time perception may be understood as a regression to an early level of development. He uses the frame of reference of Piaget and compares the perceptual disturbance with the "preoperative" level, where the time and space systems are dissolved and then brought together in an individual "egocentrique" unique way. Stein (1977) and Stein and Euper (1974) have shown that manic patients were unable to perform musical tests in a tempo other than their own inner "optimum tempo". Nielzén and Cesarec (1982c) found that an increase of tempo in a piece of music leads to the experience of more tension in normal subjects while manic psychotics experience more gaiety and more attraction as an effect of the faster tempo.

Studies investigating the emotional experience of music in psychotic patients are very few, but those concerned with neuroticism and experience of music seem to be still fewer. Iwata (1972) compared the semantic differential ratings by subjects scoring high and low on a questionnaire measuring neuroticism. Those with high scores on neuroticism experienced the music j.a. as less mild, more complex, more restrained, less relaxed and less beautiful. The ratings of subjects in a "task situation" as compared with "no task situation" showed central tendency, i.e. the ratings were less extreme. Smith and Morris (1976) investigated the effects of stimulative and sedative music on anxiety. They found that stimulative music increased both "worry" and "emotionality" aspects of anxiety, while sedative music had no effect on anxiety. The sedative music resulted in a steady increase in liking the music played, whereas the stimulative music had no such effect.

The aim of the present study is to further explore the influence of elements within the receiver on the communication of music. It is hypothesized that obviously impaired mental functioning within subjects will cause an altered emotional experience of expressive structure in music and that an alteration is specific for the disturbance in question. To secure a sufficient depth of the disturbance only in-patients should be studied and only diagnostically well-defined emotional disturbance should be included. Short pieces of music have been composed for experimental puposes and measuring

instruments have been constructed and used in previous studies (Nielzén and Cesarec, 1982a,b).

SUBJECTS

Patients of the acute psychiatric ward in a University Hospital took part in the experiments. All patients stayed under voluntary commitment. Cases of recognized alcohol and drug abuse and patients with somatic disturbances and lesions of the nervous system were not included in the study. The diagnoses were made at the ward unit by the medical staff. The patients had to fulfil relevant diagnostic criteria of DSM-III (Diagnostic and Statistical Manual, 1978). In brief the most important symptoms in the various groups were as follows: A patient was considered to be schizophrenic when disturbances of thought or delusions and hallucinations were among the crucial symptoms. However, in this group many patients were included who had passed their maximum point of productive symptoms. To be diagnosed under depressive psychosis patients had to show delusions of guilt, psychomotor retardation and somatic manifestations such as sleep or appetite disturbances. The categorization of manic psychosis required symptoms of hyperactivity, flight of ideas and decreased need for sleep. Obsessive or compulsive symptoms were obligatory in the obsessive group, depressed mood and lowered level of activity within the group of depressive neurosis and autonomic

Table I

Some identifying and background variables of the subjects with psychopathological symptoms

DSM-III DIAGNOSIS	NO	MEAN AGE	SEX		MARITAL a)				EDUCATION b)			MEDICATION c)					NO OF ADMISSIONS		MEAN NUMBER OF DAYS IN HOSPITAL BEFORE TESTING	DURATION OF ILLNESS BEFORE ADMISSION months					
			♂	♀	M	S	D	W	1	2	3	Hn	Ln	Th	Anx	ECT	Lith	1st time			2nd time				
SP	295.13	22	30	12	10	3	16	1	2	4	5	13	13	5	-	-	-	4	5	12	11.5	6	16		
DP	296.54	12	42	8	4	10	2	-	-	4	3	5	-	1	5	-	1	-	5	7	1	4	8.2	10	2
MP	296.44	10	40	4	6	7	2	-	1	3	2	5	-	-	1	-	-	3	6	5	-	5	8.0	10	-
ON	300.30	12	34	7	5	2	6	2	2	5	2	5	-	1	1	1	-	-	9	6	1	5	14.8	6	6
DN	300.40	20	41	10	10	15	4	-	1	10	7	3	1	1	4	-	3	-	11	8	5	7	8.7	19	1
AN	300.02	12	40	7	5	9	1	2	-	7	1	4	1	2	2	2	-	-	5	8	1	3	14.1	10	2
HN	301.50	19	36	8	11	11	6	1	1	11	2	6	-	1	-	1	1	-	16	14	1	4	7.5	12	7
Total		107	38	56	51	57	37	6	7	44	22	41							53	14	40		10.4	73	34

a) M = Married; S = Single; D = Divorced; W = Widowed;

b) 1 = Primary School and/or corresponding level of occupational education;
2 = High school and/or corresponding level of occupational education;

3 = Education at an academic level;

c) Hn = High dose neuroleptica; Ln = Low dose neuroleptica; Th = Thymoleptica;

Anx = Anxiolytica; ECT = Electroconvulsive therapy; Lith = Lithium;

- = no medication; - Some patients are prescribed several medications.

SP = Schizophrenic Psychosis (n=22) ON = Obsessive Neurosis (n=12)

DP = Depressive Psychosis (n=12) DN = Depressive Neurosis (n=20)

MP = Manic Psychosis (n=10) AN = Anxiety Neurosis (n=12)

P = All patients HN = Hysterical Neurosis (n=19)

manifestations and experience of painful anxiety within the group of anxiety neurosis. Hysterical neurosis had to show dissociative thinking and behaviour. Diagnostic designations according to DSM-III and some background factors are presented in Table I.

The normal subjects are a group of 100 persons, 43 men and 57 women, collected from several previous studies. Mean age for the group was 28 ranging from 19-51 with a SD of 6.6. They had no actual psychiatric disease and no present state of decompensation. They were not educated in music and their hearing acuity was normal.

MATERIAL AND METHODS

Compositions

As stimuli seven short pieces of newly composed music orchestrated for a small symphony orchestra (verbal description may be found in Nielzén and Cesarec, 1982a) were used. In a previous study (Nielzén and Cesarec, 1982b) the structural content has been described by means of ratings by musically educated raters on differential scales with reference to various structural components of music. These ratings were factor analyzed and three structural factors were extracted.

Scales

The emotional experience of the music excerpts was assessed by ratings on a semantic differential construct-
ed according to Osgood et al. (1957). In an earlier study a number of scales have been factor analyzed and shown to measure mainly three dimensions of emotional experience: TENSION-RELAXATION, GAIETY-GLOOM, ATTRACTION-REPULSION (Nielzén and Cesarec, 1982a). In the present study the four scales with the highest loadings in one of the factors and with low loadings in the others were chosen to represent each factor. TENSION-RELAXATION thus became represented by tense - relaxed, violent - peaceful, hard - soft and threatening - enticing. GAIETY-GLOOM was represented by happy - sad, humorous - serious, impulsive - controlled and active - passive. Finally, ATTRACTION- REPULSION was measured by means of rich - poor, beautiful - disgusting, profound - superficial and clear - diffuse. The ratings are summed to obtain factor scores. The factor scores varying theoretically from 4 to 28 were calculated for each factor and patient. The mean factor scores for clinical groups and the normal group were then compared by means of analysis of variance and t-test.

RESULTS

The effect of belonging to a specific group on the experience of music may express itself independently

of the single pieces of music; the mean factor scores across all pieces of music may be significantly different. In the following this will be referred to as significant "main tendency". On the other hand, when the effect of belonging to a group varies with single pieces of music the analysis of variance may result in significant "interaction".

As shown in Table II and Fig. 1, the comparison between the normal subjects and the group constituted by all patients taken together resulted in no significant differences between groups, i.e. main tendencies, but all the three interactions are significant. In all three factors the ratings in the patient group show some degree of central tendency i.e. they are less extreme at both poles of each factor. Thus the differences between normal subjects and all patients taken together are fairly small. The rankorder of the pieces of music, from the least to the most relaxed, gloomy and repulsive one is very similar for the two groups.

The comparison between the normal subjects and various diagnostic subgroups resulted in six significant or almost significant main tendencies. This and the pattern of interactions are shown in Table II. In factor I, TENSION-RELAXATION, only the group of obsessive neurotics differs significantly from the normal group, rating more tension across all pieces of music. Interactions for most diagnostic groups are signifi-

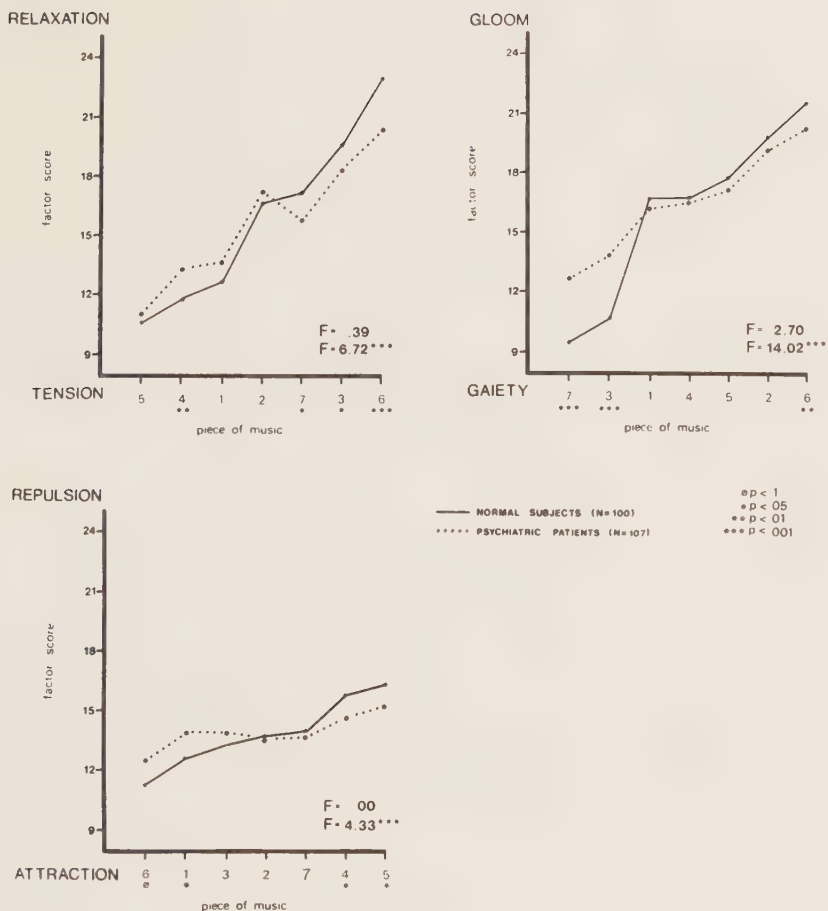


Fig. 1. Mean factor scores of the experiential factors (TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION) for the seven pieces of music. These are rank-ordered from the most to the least "tense", "gay" and "attractive" one according to the ratings by normal subjects. The upper F-values refer to main tendencies and the lower ones to interactions. The probability symbols otherwise refer to t-tests.

Table II

F-values of the analyses of variance between normal subjects (n = 100), psychiatric patients (n = 107) and different diagnostic groups

	Total n = 107	SP n = 22	DP n = 12	MP n = 10	ON n = 12	DN n = 20	AN n = 12	HN n = 19
I	.39 ns 6.72 ***	-.48 ns 5.23 ***	.77 ns 3.08 **	1.74 ns 1.92 ϕ	5.79 * 1.10 ns	.49 ns 4.10 ***	-1.51 ns 4.17 ***	.12 ns 2.87 **
II	-2.70 ns 14.02 ***	-1.39 ns 4.52 ***	-5.03 * 7.74 ***	-3.69 ϕ 3.59 **	-2.59 ns 1.36 ns	-2.19 ns 7.96 ***	-.05 ns 10.40 ***	1.34 ns .86 ns
III	.00 ns 4.33 ***	4.94 * 2.08 ϕ	-1.21 ns 2.83 **	1.41 ns 2.30 *	.08 ns 1.22 ns	-2.92 ϕ 1.59 ns	-5.26 * 2.59 *	.38 ns .73 ns

ns = not significant
 ϕ = $p < .1$
* = $p < .05$
** = $p < .01$
*** = $p < .001$

I, II and III denote experiential factors TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION. The upper values refer to differences between the means (main tendencies) and the lower ones to interactions. A minus sign indicates a lower mean factor score in the group of normal subjects.

cant because of a central tendency, which means that the patients rate less tension and less relaxation in extremely "tense" and "relaxed" pieces of music. The obsessive neurotics, who rate more tension in all pieces of music, show no central tendency and rate the "tense" and "gay" pieces of music as especially tense. The hysterical neurotics who rate more tension in the most "tense" piece of music, at the same time rate other tense pieces as more relaxed. No central tendency exists in this group either.

In factor II, GAIETY-GLOOM, the depressive and the manic psychotics rate all the music as less gay. The majority of the interactions are significant mostly due to the fact that patients rate less gaiety in "gay" pieces. There is also a tendency in all groups of patients to rate less gloom in the two pieces of music rated as most gloomy by normal subjects. This tendency reaches a significant level in the groups of the depressive neurotics and in the anxiety neurotic group.

In factor III, ATTRACTION-REPULSION, the schizophrenic psychotics rate all the music as significantly more attractive while depressive and anxiety neurotics rate all the music as less attractive than normal subjects. Also in this factor most of the interactions are significant. However, the interactions seem to be to a lesser degree due to a central tendency. Schizophrenics overemphasize attraction in the two

"least attractive" pieces. Depressive and anxiety neurotics on the other hand rate the most "attractive" pieces as less attractive. Manic psychotics differ in their ratings of two pieces representing the same composition performed in a slow and a fast tempo.

DISCUSSION

The results indicate that there are considerable deviations in the ratings by patients in comparison with normal subjects. The ratings made by patients are not disorganized or exaggerated in a way that would make one doubt the reliability of the ratings. Therefore problems connected with motivation, understanding of the instruction and ability to perform the ratings correctly, may be left out of consideration. When the pieces of music are rank-ordered according to the ratings by normal subjects from the least to the most relaxed, gloomy and repulsive one respectively, a great general concordance with the ratings by patients becomes evident (Fig. 1). The ratings by the total patient group indicate on the whole that generally music conveys the same emotional experience to patients as to the normal subjects. This is in accordance with the findings in several studies (Simon et al., 1951; Biller, 1973). However, the significant main tendencies (6/21 comparisons below the ten percent level) indicate that a specific psychiatric diagnosis may be related to altered emotional experience of this sample of music, and the many significant interactions

(18/21 comparisons below the ten percent level, Table II) point to the fact that specific pieces of music are experienced differently by patients in various diagnostic groups as compared to normal subjects.

There was a difference in mean age between the sample of normal subjects and that of patients. It was previously shown (Nielzén and Cesarec, 1982a) that increasing age is related to ratings of more attraction. The only diagnostic group showing ratings of greater attraction than the normal subjects is the schizophrenic psychotic group where the mean age is 30 (Table I). As in this group the mean age is the lowest one among all groups of patients the ratings of greater attraction evidently are related to a psychopathological factor rather than age. The much higher age (40, 41; Table I) in the depressive and anxiety neurotic groups should have been related to ratings of greater attraction. These patients, however, rated the music as more repulsive instead. The same trend is seen also in the depressive psychotic group with the high mean age of 42. Obviously, the psychopathological factors exceed age as a background factor in importance which has been found i.a. by Stein and Euper (1974).

The psychotic groups did not show any clear common deviations, but some specific characteristics in each group did become apparent. Schizophrenic psychotics thus rated all music as significantly more attractive than normal subjects. One explanation may be that

music represents a communication at a primary process level which is understandable for and appeals to the schizophrenic patient. Weber (1977) in a similar way proposes regressive mechanisms as explanations for psychotic experiences, but in Piaget's frame of reference instead of a psychodynamic one. Cattell and McMichael (1960) found a correlation between introspectiveness and preference of music which may also be important for the attraction of the music in the present study. Music is communicated without personal contact, which may mean an alleviation for the schizophrenic patients. In an unpublished cluster analysis of the present material the symptom "social contact disturbance" was found to be correlated with a cluster of individuals rating all the music as attractive. There is then supporting evidence of this typically schizophrenic symptom as being important for the rating of attraction in the music. Other circumstances may also contribute to the result. Simon et al. (1951) e.g. bring up impaired ego-functioning as an example of a factor influencing emotional experiences in schizophrenics.

The depressive psychotics rated all music as more gloomy than did normal subjects. Depressive patients usually have an inability to experience gaiety. The manic psychotics also rate the music as almost significantly less gay. As these two diagnostic groups represent patients with opposite prevailing moods, it is reasonable to assume that their ratings are deter-

mined by some common psychopathological factor rather than "prevailing mood" as was proposed in the study by Simon et al. (1951). There are authors who underline the fact that opposite traits in mania and depression are more superficial but that fundamental disturbances may be common in the two phases of the illness (Kisker et al., 1972a).

The ratings of more tension in these two diagnostic groups of "relaxed" pieces need not to be attributed only to anxiety resulting in a central tendency (see below) but may possibly be an effect also of the manic and depressive patients experiencing time as passing very slowly. This feeling may make them judge slow music as more tense. Of course other mechanisms are imaginable as well.

In factor III, ATTRACTION-REPULSION, depressive psychotics show a tendency to rate the music as more repulsive than normal subjects, which may be interpreted as an effect of anxiety (see below) while in manic psychotics the tendency is to rate the music as more attractive (especially the fastest piece). Some specific aspects of the music seem to have been more important for the ratings by manic patients. One possible influence is tempo; this has been dealt with elsewhere (Stein, 1977; Nielzén and Cesarec, 1982c).

The neurotic subgroups were characterized by some specific rating patterns too. In the anxiety neurosis group

the central tendency (cf. p.p. 116, 119) in factor I and II and the ratings of less attraction in factor III are the characteristic results. The central tendency in factor II was previously found in subjects with high need achievement, who are precautions to perform correctly. Iwata (1972) found that subjects with high neurotic scores as a consequence of the anxiety in the experimental situation rated less extremely in most variables, which supports the interpretation that anxiety may cause central tendency. The ratings of less attraction in factor III are found also in the group of neurotic depression, a group that includes many patients with ongoing anxiety. The subjects in other diagnostic groups certainly may also suffer to various extents from anxiety but in these groups other mechanisms evidently have been of greater importance for the experience of attraction or repulsion in the music.

In the hysterical and obsessive subgroups no central tendency is seen. The ratings in factor II and III are similar to those by normal subjects. In factor I the obsessive neurotics, however, find all the music as more tense than normal subjects, especially the "tense" and the "gay" pieces. A similar sensitivity to tension in "tense" pieces of music was previously demonstrated in women and in subjects with high need affiliation. In subjects in these groups, there may be a sensitivity to tension for social reasons, while obsessives may, in their sensitivity to tension, be

trying to fit the stimulus into their specific adaptational processes. In contrast to groups with overt anxiety, and in comparison with normal subjects, their perception is not screened off but is characterized by a more efficient scanning at least in relation to tension in music. In obsessives the raised sensitivity to tension may be related to their need to control their environment (Kisker et al., 1972b). The hysterical neurotics rated the most "tense" piece of music as more tense than normal subjects but on the other hand two relatively "tense" pieces were rated as more relaxed. They seem to be captivated by occasional cues in the music, which may be expected because of the dissociative and dramatizing character of these subjects (Mayer-Gross et al., 1960)

The psychiatric patients show several clearly different experiences of music in comparison with normal subjects. As far as the influences of personality factors are concerned, previous studies were only able to trace fewer and weaker ones. The psychopathology seems to be of greater importance for the emotional experience of music than age and personality factors. Except the specific psychopathological factors pertaining to each of the diagnostic groups, more general pathological factors may influence the rating results. Thus manic and depressive psychotics rated more gloom in the music which may be explained by a common factor in affective disorders. Overt anxiety as a general factor probably lies behind ratings of

more repulsion and less extreme ratings of tension and gaiety. On the other hand obsessive and hysterical neurotics showed some similarities in their ratings which may be explained by the non-existence of overt anxiety which in these groups is counteracted by different strategies of defense.

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PAPER V.

THE EFFECT OF MENTAL ILLNESS ON THE EMOTIONAL
EXPERIENCE OF MUSIC

Sören Nielzén, M.D. and Zvonimir Cesarec, Ph.D.

Department of Psychiatry, University Hospital (Head:
Professor Rolf Öhman) and Department of Psychiatric
Research, S:t Lars Hospital (Head: Professor E. Nyman),
Lund, Sweden.

SUMMARY

Psychiatric patients (N = 107) were studied regarding the importance of pertaining to a diagnostic group for the variation of emotional experience of music. Diagnostic groups chosen were the following: Schizophrenic, depressive and manic psychosis, obsessive, depressive, anxiety and hysterical neurosis. As stimulus seven newly composed pieces of music orchestrated for a small symphony orchestra were used. The assessment of emotional experience was accomplished by semantic differential scales measuring the factors TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION. The most conspicuous findings were: The anxiety neurotic patients experienced the music as neutral in tension and gaiety, but repulsive. Hysterics experienced more gaiety and attraction together with varying degrees of tension, obsessives more tension, depressive psychotics more gloom and schizophrenics more attraction than other groups.

Key words: Mental illness, emotional experience, music.

In psychiatric research very few studies exist where music is used as a stimulus. Sometimes music is the object of speculation and circumscribed pilot studies of therapeutic approaches. In this context, opinions on the effects of psychopathology on the perception of music vary from one extreme to the other. It has been proposed that the experience of music is affected in a specific way in each psychopathological state (Willms, 1973), but others assume that the experience of music even by psychotic patients is comparable to the experience by normal subjects (Altschuler and Shebesta, 1971). Even studies where objective quantitative measures are used have given contradictory results.

The literature describing emotional effects of music in psychopathological states shows scattered and often unprecise results. A part of relevant literature deals with the relation of music to the psychopathology of schizophrenia, which includes deficits in symbol functioning and inadequate emotional experiences. De Wolfe et al. (1973, 1975) asked schizophrenic patients to rate their preference of excerpts of irritating and relaxing music. An important finding was that schizophrenics who adapted to the stress in the experimental situation preferred relaxing music to a greater extent. Reactive schizophrenics showed greater preference for relaxing music than process schizophrenics. It was hypothesized that the tendency to prefer relaxed music was a measure of responsiveness and capacity to differ-

rentiate among external stimuli. Physiological methods to study reactions to music in schizophrenic and depressive patients were used by Weidenfeller and Zimney (1962). GSR (Galvanic Skin Response) was measured during exposures to a series of excerpts of calming and exciting music. Skin resistance increased with the exposure to calming music which was similar to the reaction of normal subjects. However, the response in schizophrenic patients was less marked than in the normals. This comparatively muted response is explained by the reduced emotional contact with reality in schizophrenics.

Depressive psychotics were used in a study of the emotional experience of music by Simon et al. (1951). Together with normal subjects, they were more inclined to recognize sad quality in the music than schizophrenic and manic psychotics.

The effect of anxiety on the perception of music is interesting because of the importance of anxiety in pathological states. Stanton (1975) found that performance in test situations improved by listening to sedative music and those with high text anxiety reported experience of more relaxation. In a study by Smith and Morris (1976) it was found that exposure to stimulative music resulted in higher scores in emotional (psychological) and cognitive (worry) aspects of anxiety, while exposure to sedative music had no similar effect.

Sensation-seekers were studied as contrasted to anhedonic patients by Watson, Anderson and Schulte (1977). High sensation-seekers rated the music significantly more enjoyable than patients scoring low in sensation-seeking, who disliked all types of music, especially those pieces of music rated as grating. The findings were interpreted to support the view that anhedonic and sensation-seeking deficits represent entirely separate emotional deficits related to process schizophrenia and neurotic tendencies respectively.

The psychopathology in manic psychotics was studied by Johanna Stein (1977) who found that manic psychotics were unable correctly to reproduce tempo unless this was in the proximity of their own inner "optimum tempo". She also studied the reactions in various psychopathological groups (Stein (1974)). In a paper from 1974 she states: "Patterns of altered perception in these troublesome categories (schizophrenic, manic-depressive and organic brainsyndromes) are sharply differentiated from one another, diagnostic differences far exceeding individual differences. Wide variability in social class, age, race, religion, education, and musical talent, interest, training and experience were irrelevant to the perceptual errors of the several hundred patients examined to date".

The aim of the present study is to focus upon the emotional experience of music by mental patients with symptoms of emotional disturbances. In a previous stu-

dy ratings of the same newly composed pieces of music by psychiatric patients and normal subjects were compared (Nielzén and Cesarec, 1982c). Explicable differences were found between diagnostic groups and normal subjects. In comparing the diagnostic groups with each other, the contrasting characteristic deviating patterns of experience are presumed to become more apparent than in comparisons with normal subjects.

SUBJECTS

One hundred and seven patients of a psychiatric clinic at a university hospital took part in the study. All patients were voluntarily admitted in-patients. The subjects were diagnosed by the ward staff, but to be included in the study the patients had to comply with the criteria of diagnostic groups according to DSM-III (Diagnostic and Statistical Manual, 1978). All cases with symptoms of lesions in the brain were omitted, as were severe cases of abuse of alcohol and narcotics. Patients with more severe somatic diseases or with impaired hearing acuity were not included. The diagnostic groups that were chosen for the study were schizophrenic, depressive and manic psychosis; obsessive, depressive, anxiety and hysterical neurosis. Schizophrenia was diagnosed when disturbances of thought, delusions of hallucinations were important symptoms. However, in this group many patients were included who had passed their maximum point of productive symptoms. Depressive psychotics should show

Table 1

Some identifying and background variables of the subjects with psychopathological symptoms

DSM-III DIAGNOSIS	NO	MEAN AGE	SEX		MARITAL STATUS a)				EDUCATION b)			MEDICATION c)					DURATION OF ILLNESS BEFORE ADMISSION				
			♂	♀	M	S	D	W	1	2	3	Hn	Ln	Th	Anx	ECT	Lith	months			
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DP	296.54	12	42	8	4	10	2	-	-	4	3	5	-	1	5	-	1	-	5	10	2
MP	296.44	10	40	4	6	7	2	-	1	3	2	5	-	-	1	-	-	3	6	10	-
ON	300.30	12	34	7	5	2	6	2	2	5	2	5	-	1	1	1	-	-	9	6	6
DN	300.40	20	41	10	10	15	4	-	1	10	7	3	1	1	4	-	3	-	11	19	1
AN	300.02	12	40	7	5	9	1	2	-	7	1	4	1	2	2	2	-	-	5	10	2
HN	301.50	19	36	8	11	11	6	1	1	11	2	6	-	1	-	1	1	-	16	12	7
Total	1	107	38	56	51	57	37	6	7	44	22	41							73	34	

a) M = Married; S = Single; D = Divorced; W = Widowed;

b) 1 = Primary School and/or corresponding level of occupational education;

2 = High school and/or corresponding level of occupational education;

3 = Education at an academic level;

c) Hn = High dose neuroleptics; Ln = Low dose neuroleptics; Th = Thymoleptics;

Anx = Anxiolytics; ECT = Electroconvulsive therapy; Lith = Lithium;

- = no medication; - Some patients are prescribed several medications.

SP = Schizophrenic Psychosis (n=22) ON = Obsessive Neurosis (n=12)

DP = Depressive Psychosis (n=12) DN = Depressive Neurosis (n=20)

MP = Manic Psychosis (n=10) AN = Anxiety Neurosis (n=12)

P = All patients HN = Hysterical Neurosis (n=19)

delusions of guilt, psychomotor retardation and sleep disturbances. The categorization of manic psychosis required symptoms of hyperactivity, flight of ideas and decreased need for sleep. Obligatory symptoms within the neurotic groups were obsessive or compulsive symptoms in the obsessive group, depressed mood and lowered level of activity within the depressive neurosis group, and sympathetic manifestation and painful anxiety at the subjective level within the group of anxiety neurosis. Hysterical neurotics should show symptoms of dissociative thinking and behaviour. The diagnostic categories and some identifying data are presented in Table I.

MATERIAL AND METHODS

Compositions

As stimuli in the experiments short pieces of newly composed music orchestrated for a small symphony orchestra were used. A verbal description of the compositions is presented in a previously published study (Nielzén and Cesarec, 1981). The compositions have also been rated by 8 musically educated raters on scales describing structural elements (Nielzén and Cesarec, 1982a). These scales were factor analyzed and three main factors of structure emerged: SIMPLE-SOPHISTICATED, VIVID-PLACID and DARK-LIGHT. The first factor was constituted by the scales Consonant-dissonant, Major-minor, Melodious-amelodious and unsophisticated-

Table II

Factor scores of the structural factors of the compositions.

The negative and positive indexes denote the relative amount of structures pertaining to the pole in question as subjectively judged.

Pieces of Music	SIMPLE - SOPHISTICATED		VIVID - PLACID		DARK - LIGHT	
	consonant - dissonant major - minor melodious - amelodious unsophisticated - sophisticated rhythmic articulation		ff - pp marked - vague staccato - legato fast - slow		minor - major bass - treble	
(1)	(-)	9.76	(--)	8.38	(-)	5.00
(2)	(+)	15.50	(+)	13.26	(--)	4.63
(3)	(--)	8.50	(--)	7.50	(+)	7.25
(4)	(+)	13.62	(-)	9.01	(+)	7.12
(5)	(+)	14.62	(-)	9.21	(-)	5.62
(6)	(--)	6.12	(++)	16.25	(++)	7.37
(7)	(--)	7.88	(--)	6.26	(++)	7.50

sophisticated, rhythmic articulation, factor VIVID-PLACID by Fortissimo-pianissimo, Marked-vague rhythm, Staccato-legato and Fast-slow tempo and DARK-LIGHT by Minor-major and Bass-treble. Factor scores for these structural factors have been computed and are presented in Table II.

Scales

The emotional experience of the compositions was assessed by means of a semantic differential constructed according to Osgood (1957). In a former study a number of scales have been factor analyzed and shown to measure mainly three factors of emotional experience: TENSION-RELAXATION, GAIETY-GLOOM and ATTRACTION-REPULSION (Nielzén and Cesarec, 1981). Four scales with the highest loadings in one of the factors and with low loadings in the others were chosen to represent each factor. TENSION-RELAXATION thus became represented by Tense-relaxed, Violent-pieceful, Hard-soft and Threatening-enticing. GAIETY-GLOOM was represented by Happy-sad, Humorous-serious, Impulsive-controlled and Active-passive. Finally, ATTRACTION-REPULSION was measured by means of Rich-poor, Beautiful-disgusting, Profound-superficial and Clear-diffuse. Factor scores were computed for each factor and piece of music by summing the ratings. The mean factor scores in the different clinical groups were compared by means of analysis of variance and t-test.

RESULTS

F-values from the analysis of variance are presented in Table III. In Table IV, showing the t-values, the pieces of music are rank ordered from the least to the most relaxed, gloomy and repulsive piece respectively according to the mean ratings by all patients taken together. Most differences pertain to a few diagnostic groups in each of the experiential factors and these groups are framed in the tables. The results will be presented in the order suggested by the frequency of significant differences in the respective diagnostic groups.

As can be seen in Table III the psychotic groups do not differ from each other, only one almost significant difference emerging in factor III, ATTRACTION-REPULSION, between depressive and schizophrenic psychotics ($F = 3.22, p < .08$). The significant differences are more numerous in comparisons between neurotic versus psychotic groups and between different neurotic groups.

Comparisons of ratings in experiential factor I:

TENSION-RELAXATION

Obsessive neurotic group: Significant main tendencies¹

¹The diagnostic groups may differ significantly in the mean factor scores across all pieces of music which is here called "significant main tendency". If the variation of the experience of the single pieces of music is dependent on the diagnosis to a significant extent, this is referred to as "significant interaction".

TABLE III

F-values of the analyses of variance of ratings by different psychopathologic groups of patients.

FACTOR I (TENSION - RELAXATION)					FACTOR II (CARET - CLOAK)					FACTOR III (ATTRACTION - REPULSION)				
SP	DP	MP	ON	AN	SP	DP	MP	ON	AN	SP	DP	MP	ON	AN
DP	-1.24													
MP	2.30	.09												
ON	-6.47*	-.90	-.37											
DN	-1.38	.08	.53	2.92										
AN	.38	2.07	3.47 ϕ	8.64**	3.10 ϕ									
IN	-.51	.15	.51	2.12	.05									

The frames indicate those groups that have shown significant main tendencies or interactions. The different lines (solid, broken and dotted) have been chosen only to make the reading easy.

A negative index denotes a lower mean factor score in the diagnostic group listed to the left in the line concerned. The upper figures denote main tendencies and the lower interactions.

- ϕ = $p < .1$
- * = $p < .05$
- ** = $p < .01$
- *** = $p < .001$
- SP = Schizophrenic Psychosis (N = 22)
- DP = Depressive Psychosis (N = 12)
- MP = Manic Psychosis (N = 10)
- ON = Obsessive Neurosis (N = 12)
- DN = Depressive Neurosis (N = 20)
- AN = Anxiety Neurosis (N = 12)
- IN = Pysterical Neurosis (N = 19)

Table IV

Table of t-values in comparisons showing significant interactions.

FACTOR I (TENSION - RELAXATION)							
	5	4	1	7	2	3	6
ON/SP	-4.30***	-4.45***	-1.09	-2.02 ^φ	-.30	.75	1.01
ON/DP	-2.82**	-2.77**	-.64	-1.13	-.39	1.31 ^φ	1.08
ON/MP	-1.73 ^φ	-1.90 ^φ	.24	-1.81 ^φ	.96	1.25	.90
AN/ON	5.39***	3.96***	1.51	1.92 ^φ	.60	-.63	-.79
AN/IN	5.27***	2.34*	.31	.09	-.86	.07	-.00
IN/SP	-4.09***	-2.78**	.19	-.25	1.18	.10	1.32
IN/DP	-2.50*	-1.42	.69	.48	.92	1.30	1.40
IN/DN	-2.71**	-1.97 ^φ	.73	.70	1.18	.01	1.32
IN/MP	-1.42	-1.10	1.93 ^φ	-.27	2.22*	.61	1.15
FACTOR II (CAIETY - GLOOM)							
IN/AN	-2.63*	-2.63*	.51	-.94	.79	-.08	3.22**
IN/DN	-2.67*	-2.28*	-.74	-1.17	.50	.97	-.22
IN/DP	-2.15*	-3.25**	.04	-1.94 ^φ	-.46	.12	.21
AN/SP	1.15	.86	-.58	.56	-.95	-.45	-3.33**
AN/ON	1.37	1.21	-1.93 ^φ	-.13	-.51	-1.11	-2.60*
DP/ON	1.16	1.90 ^φ	-1.12	.97	.58	-1.07	-.57
FACTOR III (ATTRACTION - REPULSION)							
	6	7	2	3	1	4	5
DN/MP	2.04*	2.34*	.99	-1.30	.55	.26	1.68
AN/ON	1.02	.25	2.52*	-.13	2.91*	-.13	.37

The pieces of music (1-7) are rank ordered according to increasing mean factor scores of the ratings by all patients.

A negative index signifies a lower factor score in the first mentioned diagnostic group.

φ = p < .1
 * = p < .05
 ** = p < .01
 *** = p < .001

SP = Schizophrenic Psychosis (N = 22)
 DP = Depressive Psychosis (N = 12)
 MP = Manic Psychosis (N = 10)
 ON = Obsessive Neurosis (N = 12)
 DN = Depressive Neurosis (N = 20)
 AN = Anxiety Neurosis (N = 12)
 IN = Hysterical Neurosis (N = 19)

are found in comparison with schizophrenic psychotics and anxiety neurotics because the obsessive neurotic patients rated all the music as more tense. The significant interactions are due to the obsessive neurotics having rated pieces 5, 4 and 7 as significantly more tense than the schizophrenic psychotics and pieces 5 and 4 as significantly more tense than patients in the depressive psychotic, depressive neurotic and anxiety neurotic groups.

Anxiety neurotic group: Anxiety neurotic patients rate all the music as significantly less tense (see above) than the obsessive neurotics. This is the highest significant difference noted in the study ($F = 8.64$).

Nearly significant main tendencies are seen also in relation to the groups of manic psychosis and depressive neurosis. The anxiety neurotic patients tend to rate all the music as less tense ($F = 3.47$, $p < .07$; $F = 3.10$, $p < .09$). Interactions are significant in comparisons with the obsessive and hysterical diagnostic groups. The anxiety neurotic patients' experience less tension, especially in pieces 5 and 4, the most tense ones according to the mean ratings by all patients taken together.

Hysterical neurotic group: There are no significant main tendencies but the interactions are significant in the comparisons with all diagnostic groups except the obsessive neurotic one. The hysterical neurotics rate more tension in the most "tense" pieces 5 and/or 4.

In comparison with the manic psychotics the hysterical neurotics rate less tension in pieces 1 and 2.

Comparisons of ratings in experiential factor III:

GAIETY-GLOOM

Hysterical neurotic group: The hysterical patients tend to rate all music as more gay compared to the other diagnostic groups. The difference is significant in comparison with depressive and manic psychotics and depressive neurotics and nearly significant in comparison with obsessive neurotics. The interactions in comparison with depressive psychotics and anxiety and depressive neurotics are significant mainly due to the experience of more gaiety in pieces 7 and 3 by the hysterical patients. Compared with anxiety neurotics the hysterical patients experience piece 6 as significantly more gloomy.

Anxiety neurotic group: The anxiety neurotic patients show no significant main tendencies but a few significant interactions. The significant interactions in comparison with the schizophrenics and the obsessives are mainly due to the experience of less gloom in piece 6 by the anxiety neurotics. The anxiety patients tend to rate less gaiety in "gay" pieces of music and less gloom in "gloomy" pieces of music, which as seen in Table IV becomes most apparent in comparison with the hysterical neurotics. The same general pattern of

ratings lies behind also the nearly significant interactions in comparison with the manic psychotics and the depressive neurotics.

Depressive psychotic group: There is a significant main tendency in comparison with the hysterical neurotic group reflecting ratings of more gloom by the depressive psychotics. There are also two significant interactions, namely in comparison with obsessive and hysterical neurotics.

Comparisons of ratings in experiential factor III:

ATTRACTION-REPULSION

Schizophrenic psychotic group: Schizophrenic patients experience all the music as significantly more attractive in comparison with depressive and anxiety neurotics and almost significantly in comparison with the depressive psychotic group ($F = 3.22$, $p < .08$).

Anxiety neurotic group: All the music is experienced by anxiety neurotic patients as significantly more repulsive compared with the schizophrenic group. Likewise they tend to experience more repulsion in all the music in comparison with the manic psychotic and the hysteric neurotic patients ($F = 3.51$, $p < .08$; $F = 3.82$, $p < .06$). The significant interaction in comparison with obsessive neurotics is mainly due to experience of more repulsion in pieces 2 and 1 by the anxiety neurotic group.

Neurotic depressive group: In addition to their experience of significantly more repulsion in all the music in comparison with the schizophrenic psychotics, the neurotic depressive group shows also a significant interaction in comparison with the manic psychotics. They rate the most "attractive" pieces 6 and 7 as significantly less attractive.

DISCUSSION

The anxiety neurotic group seem to show the most widespread differences in their experience of music, differing from the other diagnostic groups in all three experiential factors. They experience less tension in all music, especially in the most "tense pieces", they show more central tendency when rating gaiety or gloom in the music and they tend to experience all the music as less attractive. In the study by Smith and Morris (1976) it was found that anxiety neurotics scored higher on worry items when they were exposed to stimulative music. This implies that the anxiety patient is easy to upset. It is possible that the worry and easy arousability of anxiety patients lead to an avoidance of becoming involved in feelings of either gaiety or gloom; tension is denied or screened off and the engaging quality of music makes it become repulsive to the patient.

The obsessive neurotic patients experience more tension in the music than do other patients. Particularly

pieces 5 and 7 - generally rated as the most tense ones - and the most "gay" piece, no. 7, are rated by obsessives as especially tense. Tension has previously been found to be emphasized by women and by subjects with high need affiliation (Nielzén and Cesarec, 1981). The somewhat increased sensitivity to tension may in these groups be the consequence of their striving for maintainance of good social relation. In obsessive neurotics there is rather a strong requirement to control the environment and in consequence of this their attention is intense and narrowly focused on what is relevant to this purpose. This may be one possible explanation of the increased sensitivity to tension in music as well as their documented sensitivity to environmental aggressiveness (Schulz-Hencke, 1930).

The hysterical neurotics also rated the most "tense" pieces of music as more tense than other patients but at the same time they rated pieces no. 1 and 2 as more relaxed. The hysterical patient experiences all the music as more gay and seems to find the music fairly attractive. Hysterical neurotics are known to be very susceptible to what is vivid or striking and their attention is easily captured by different details. The variability in their ratings of tension in music may reflect the hysterically dissociative tendencies; they may more easily than others be captured by special cues that become inappropriately enlarged. The experience of more gaiety and attraction in music is in line with the findings by Watson et al. (1978) who found that

high sensation-seekers tend to like all types of music in contrast to low sensation-seekers, who disliked all types of music, especially those rated as grating.

Schizophrenic psychotic patients rated the music as more attractive than many other groups. Disturbances of interpersonal contact and reduced emotional contact with reality are common in schizophrenics. Music is an impersonal way of communication and contains usually little specific denotative meaning. Thus the music may appeal to the schizophrenic patients as a stimulus fitting into the primary processes and easily lending itself to unrealistic and autistic imagination.

The depressive psychotics rated all the music as more gloomy than other groups. Even if it has been difficult to find evidence of similar results in the literature (cf. Simon et al., 1951) this result is highly expected from a clinical standpoint.

The depressive patient is clinically characterized by a global negative, dark and gloomy emotional tone and shows difficulties in experiencing gaiety in any kind of stimuli (Mayer-Gross, Slater and Roth, 1960).

In the manic psychotic group no characteristics beyond previous findings regarding tempo have been revealed (Nielzén and Cesarec, 1981b). The attractiveness of

piece no. 7 experienced by these patients certainly has to do with the high tempo of this piece of music.

Each of the diagnostic groups shows in comparison with the other groups some specific trends in the emotional experience of music. The majority of these trends are quite weak but they seem to be related to the psychopathological characteristics of the group. The modes of experiencing the emotional qualities of the music most likely reflect more profound emotional disturbances and other pathological traits in the psychiatric patients.

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APPENDIX

Table A
Mean and standard deviation of ratings by 8 musically educated raters of technical elements in the reference
sample of compositions.

	1	2	3	4	5	6	7						
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Harmony	3.00	2.00	2.00	3.50	1.88	2.63	2.38	3.75	2.13	2.13	4.88	3.38	3.50
	(1.20)	(0.93)	(1.31)	(1.41)	(0.84)	(1.06)	(1.19)	(1.49)	(0.99)	(1.36)	(0.35)	(1.19)	(1.31)
	3.13	4.00	2.63	2.00	3.38	2.63	2.75	2.88	3.38	3.13	2.13	2.50	1.75
Modality	(0.99)	(0.93)	(0.92)	(0.93)	(1.19)	(0.92)	(1.39)	(1.55)	(1.19)	(1.36)	(1.81)	(1.31)	(1.04)
Melody	2.13	3.25	2.75	2.50	2.88	3.50	3.00	2.25	3.50	3.50	1.50	1.50	2.13
	(1.36)	(1.39)	(1.49)	(1.31)	(1.25)	(1.41)	(1.20)	(1.49)	(0.93)	(1.31)	(1.07)	(0.76)	(1.25)
	4.25	3.38	3.63	3.63	3.50	4.00	4.13	3.63	4.13	3.00	2.88	3.75	4.25
Intensity	(0.46)	(0.92)	(0.52)	(0.52)	(0.54)	(0.00)	(0.35)	(0.92)	(0.99)	(0.76)	(0.84)	(0.89)	(0.71)
Pitch	2.13	2.63	3.13	3.25	3.25	3.75	4.00	3.50	3.00	2.50	3.50	3.25	3.25
	(0.35)	(0.92)	(0.99)	(0.89)	(0.89)	(1.04)	(0.76)	(0.93)	(1.20)	(0.93)	(0.54)	(1.04)	(1.17)
	1.25	2.88	1.50	1.25	1.75	2.13	2.75	3.00	2.13	3.38	3.25	3.13	1.00
Rhythm	(0.71)	(1.36)	(0.54)	(0.46)	(0.46)	(1.25)	(1.39)	(1.51)	(0.99)	(1.60)	(1.99)	(1.25)	(0.00)
Rhythmic	4.50	1.75	3.38	4.50	3.00	1.88	2.00	3.00	2.13	2.13	4.63	3.75	4.50
	(0.54)	(0.46)	(1.51)	(1.07)	(1.20)	(0.99)	(1.31)	(1.60)	(0.84)	(1.36)	(0.74)	(0.89)	(1.07)
	2.25	3.88	3.38	1.50	1.63	2.00	2.38	3.63	2.50	2.88	4.88	4.75	1.63
Continuity	(0.89)	(0.99)	(1.06)	(0.76)	(0.74)	(0.54)	(1.06)	(1.06)	(0.76)	(1.13)	(0.35)	(0.46)	(0.52)
Tempo	3.13	3.88	2.63	2.38	2.25	2.88	2.13	2.50	2.71	3.50	5.00	4.00	1.88
	(0.84)	(0.64)	(0.74)	(0.74)	(0.71)	(0.99)	(0.64)	(0.76)	(0.76)	(0.76)	(0.00)	(0.00)	(0.64)

Table B
Mean and standard deviation of ratings by 8 musically educated raters of technical elements in the sample of classical music.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Harmony	3.83 (0.98)	4.83 (0.41)	5.00 (0.00)	4.33 (0.52)	1.00 (0.00)	4.33 (1.21)	3.67 (0.82)	1.33 (0.82)	2.00 (1.55)	3.33 (1.51)	1.67 (0.52)	2.33 (0.52)	3.67 (1.03)
Modality	1.67 (1.21)	1.83 (0.41)	3.50 (1.23)	1.83 (0.41)	3.17 (0.41)	1.67 (0.52)	2.83 (0.98)	2.83 (0.41)	2.83 (1.33)	2.50 (1.05)	3.33 (0.52)	3.00 (0.89)	3.17 (0.75)
Melody	1.33 (0.52)	1.50 (1.23)	1.33 (0.52)	3.00 (1.10)	5.00 (0.00)	1.33 (0.52)	2.83 (0.75)	3.83 (0.41)	2.17 (0.41)	1.17 (0.41)	4.00 (0.00)	2.83 (0.98)	2.67 (1.03)
Intensity	4.33 (0.52)	3.67 (0.82)	2.17 (0.41)	3.33 (0.52)	4.00 (0.00)	2.33 (0.52)	4.50 (0.55)	2.00 (0.63)	4.50 (0.55)	3.17 (0.75)	3.66 (0.82)	4.00 (0.89)	1.50 (0.55)
Pitch	3.33 (0.52)	3.50 (0.55)	4.17 (0.75)	2.33 (0.82)	3.17 (0.41)	4.33 (0.52)	2.67 (0.52)	3.33 (0.82)	2.66 (0.82)	3.50 (1.05)	4.17 (0.75)	2.33 (0.52)	4.00 (0.63)
Rhythm	1.50 (0.55)	2.33 (1.03)	3.50 (1.23)	1.83 (0.41)	5.00 (0.00)	1.50 (0.55)	1.50 (0.84)	2.83 (1.17)	1.50 (0.84)	1.00 (0.00)	4.50 (0.55)	1.33 (0.52)	4.50 (0.55)
Rhythmic articulat.	3.67 (1.37)	4.33 (0.82)	4.50 (0.55)	4.50 (0.55)	1.67 (0.82)	4.80 (0.45)	3.83 (0.41)	3.66 (1.21)	2.33 (0.82)	4.00 (1.55)	1.83 (0.41)	2.33 (1.37)	3.33 (1.51)
Continuity	2.67 (0.82)	3.17 (1.33)	5.00 (0.00)	2.17 (0.98)	4.67 (0.82)	2.33 (0.82)	2.17 (0.41)	3.17 (1.17)	2.66 (0.82)	2.00 (0.00)	3.67 (0.82)	2.00 (1.27)	4.00 (1.10)
Tempo	1.50 (0.55)	3.17 (0.98)	4.67 (0.52)	2.17 (0.41)	4.33 (0.52)	2.17 (0.41)	1.83 (0.75)	4.17 (0.41)	2.00 (0.89)	3.50 (0.84)	3.67 (1.03)	1.67 (2.21)	4.50 (0.55)

Table C

Table of t-values in comparisons between ratings of music in the experiential factors by normal subjects (n = 100) and patients (n = 107) totally and in various diagnostic groups. The pieces of music are rank-ordered from the most to the least "tense", "gay" or "attractive" ones, respectively.

Factor I							
Tension - Relaxation							
	5	4	1	2	7	3	6
N/P	-.79	-2.99**	-1.51	-.50	2.09*	2.49*	4.20***
N/SP	-2.55*	-4.31***	-1.37	-.18	.57	1.22	2.78**
N/DP	-.90	-1.71 ^Ø	-.57	-.33	1.64	2.50*	2.90**
N/MP	-.15	-1.13	.91	1.49	.34	2.06*	2.32*
N/CN	3.10***	1.95 ^Ø	.34	-.20	2.80**	.13	.60
N/DN	-.60	-2.41*	-.69	-.10	1.68 ^Ø	1.11	2.60*
N/AN	-3.99***	-3.47***	-2.23*	-.73	.92	1.10	2.06*
N/HN	2.81**	.12	-1.61	-1.46	.68	1.09	.75

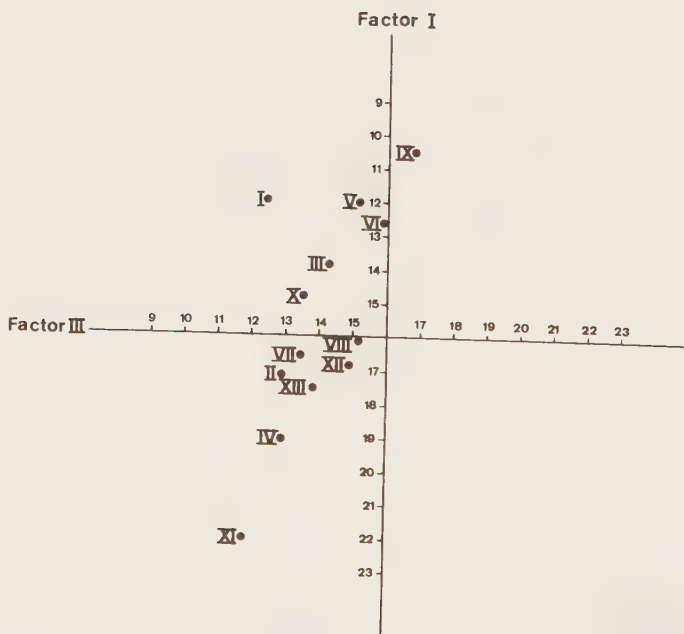
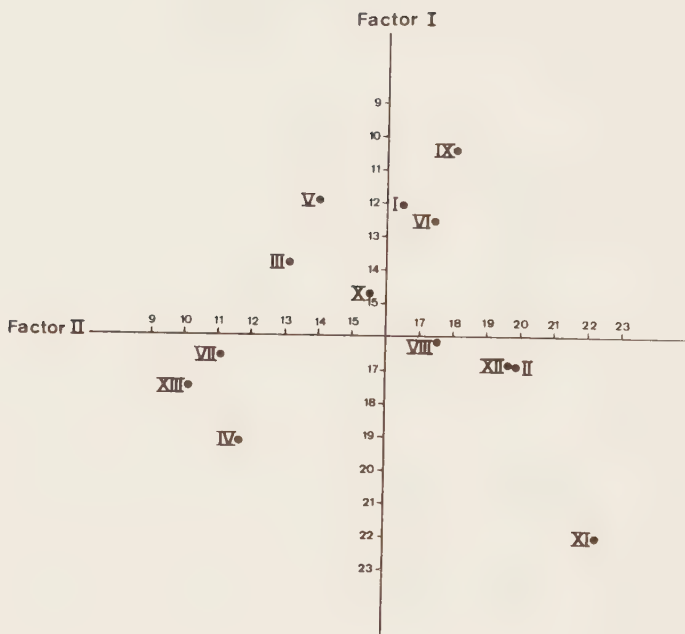
Factor II							
Gaiety - Gloom							
	7	3	1	4	5	2	6
N/P	-5.49***	-5.43***	.32	.41	1.07	1.57	2.96**
N/SP	-2.70**	-3.22**	.73	.63	.71	.59	.61
N/DP	-2.94**	-4.03***	.39	-1.46	-.04	.83	1.14
N/MP	-2.40*	-3.72***	.02	.35	-1.23	.21	1.13
N/CN	-1.65	-1.38	-1.33	-.26	.84	-.62	.28
N/DN	-4.18***	-3.31**	-.36	-.42	1.66 ^Ø	3.01**	1.69 ^Ø
N/AN	-3.65***	-3.51***	1.23	-.09	1.60	.91	5.07***
N/HN	-1.09	-.33	.56	1.15	.73	.95	1.64

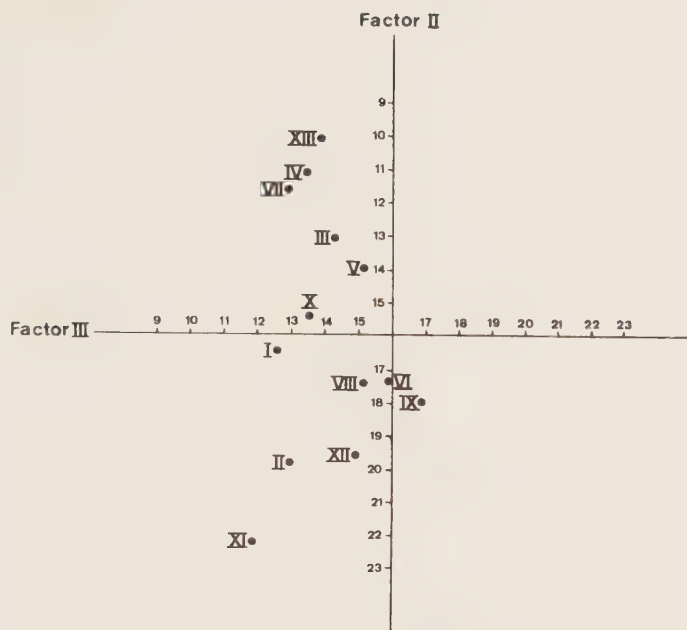
Factor III
Attraction - Repulsion

	6	1	3	2	7	4	5
N/P	-1.80 ^ϕ	-2.09*	-.97	.08	.90	2.27*	2.15*
N/SP	.26	-.42	1.05	.46	1.41	2.60*	2.88**
N/DP	-1.41	-1.26	-1.75 ^ϕ	-.03	-1.01	1.92 ^ϕ	.83
N/MP	.48	-.49	-1.86 ^ϕ	.68	2.02*	.07	1.53
N/CN	-.56	.70	-2.02*	1.37	-.11	.24	.98
N/DN	-3.19**	-1.28	-.42	-.69	-1.00	.64	-.63
N/AN	-1.91 ^ϕ	-3.51***	-1.46	-1.97 ^ϕ	-.54	.49	1.07
N/HN	-.25	-.88	.87	.57	1.25	.56	.88

ϕ = $p < .1$ SP = Schizophrenic Psychosis (n=22) CN = Obsessive Neurosis (n=12)
 * = $p < .05$ DP = Depressive Psychosis (n=12) DN = Depressive Neurosis (n=20)
 ** = $p < .01$ MP = Manic Psychosis (n=10) AN = Anxiety Neurosis (n=12)
 *** = $p < .001$ P = All patients HN = Hysterical Neurosis (n=19)

A minus sign indicates a lower factor score in the normal group (N).





Figures illustrating findings in Study I.

Positions of the 13 compositions in two-dimensional factor space. The dots represent factor scores of TENSION-RELAXATION (Factor I), GAIETY-GLOOM (Factor II) and ATTRACTION-REPULSION (Factor III).

A phonographic record containing two tracks, the first one with 7 pieces of music used in Studies II-IV and the second one with all pieces (13) composed for Study I, is available on special request from the author.

Omslag Per Nilsson
Animusica Studio
Infotryck AB, Malmö